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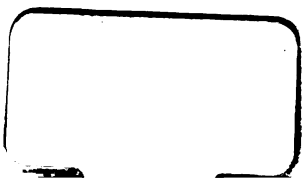

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Municipal Engineering

VOLUME XX. JANUARY, NINETEEN HUNDRED ONE. NUMBER 1.

RELIEF OF CONGESTED STREET TRAFFIC IN BOSTON.

An important question in some of the older and larger cities is the relief of the congestion of traffic in narrow streets and those crowded with car tracks and the travel of vehicles and foot passengers.

The city of Boston has done much in solving its own problem of this class in recent years, but the work is not yet completed. The needs of the Devonshire and Exchange street districts are shown graphically by a series of pictures which are presented this month. Of the thousands of tons of freight passing through the wholesale business district every day to and from the northern railway terminals and the steamship docks, a large part must pass through one or the other of these two streets, the other north and south streets being almost impracticable.

The first view shows, from the outlet of Congress street, the position of Exchange and Devonshire streets as they leave the opposite side of State street. Their narrowness and the difficulty of entering them are well shown. The condition of State street in the full tide of ordinary traffic, is shown by the second view. The obstruction to cross-town traffic by the street railways in Devonshire, State and Congress streets is well shown. The almost complete occupation of Devonshire street by car tracks is shown in the third view. Its width is but fifty to fifty-five feet between curbs. Exchange street is but twenty-three to twenty-six feet between curbs. It is proposed to widen the latter street thirty-one feet on the easterly side. The first view, mentioned above, shows that this would make Exchange street practically an extension of Congress street, and thus relieve the difficulty of the reverse curve of traffic in crossing State street. The fourth view shows Dock square, opposite Exchange street, and the corner building, which it is proposed to cut off to make a good entrance into Union street. These improvements, supplementing the proposed subway on Washington street, which will remove much of the street car traffic from Congress street, will greatly relieve the present congestion.

The difficulties in other cross-town streets are exemplified in the fifth view, one of Merchants' Row, the next street below Exchange and Devonshire streets. The view, taken from the intersection with State street, shows the narrow outlet into North street. In addition, market teams crowd Faneuil Hall square on all week days.

The relief desired is now under discussion and in some form will probably be the next improvement of this nature in the city.

The improvement in Tremont street by the comprehensive treatment of the problem of its congestion of traffic, which involved the construction of the present subways, is shown in the next three views. The sixth view shows Tremont street, looking north from Park street, under the former conditions. The seventh view shows the street looking north from West street, and the eighth, near Boylston street, under present conditions. It is evident that the change in conditions is worth a large sum of money, and, without reference to other advantages innumerable, fully justifies the large expenditure made necessary in constructing the subway and removing the surface tracks and wires. The next step is repaving the street with asphalt or blocks as the street grades require.

The ninth and tenth views show that some of the improvements made in the traffic conditions are not without alloy. The ninth view shows Washington street looking north from Clifton Place before the elevated railway was constructed, and the tenth the same street near Dover street after the elevated railway structure was completed.

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Undoubtedly the new railway is a material relief to the traffic of the city at large and in some respects to that of Washington street itself, but there is a disfigurement of the street, instead of the improvement in appearance which follows all the other changes made or proposed. The advantages outweigh the disadvantages, however, and the new railway will be found quite indispensable.

THE MECHANICAL SYSTEM OF WATER FILTRATION.

By Floyd Davis, E. M., Ph. D.

Mechanical filters are generally constructed as vertical cylinders, from ten to eighteen feet in diameter, with a height considerably greater than their diameter. Through some the water flows by gravity, and through others it flows under pressure. In each cylinder is a horizontal partition containing a large number of fine openings, through which the water is allowed to pass during filtration. On this partition rests from two to four feet of fine sand suitable for filtering. The water is allowed to sink through this during filtration twenty to one hundred times as fast as it sinks through English filters. This difference in rate of flow is perhaps the greatest distinction between these two types of purifiers. An average rate of 128,000,000 gallons per acre in twenty-four hours has been found most desirable for some American waters. As the length of a run is somewhat in inverse ratio to the rapidity of filtration, these filters must necessarily be cleaned frequently. Instead of being scraped by hand, as in the English type, they are washed, by allowing a reverse current of water to flow up through them. At the same time the sand is agitated by revolving arms projecting into it and kept in motion by mechanical means, from which fact these are known as mechanical filters. The wash water is discharged, just above the surface of the sand, into a sewer connection. About two or three per cent. of filtered water is required for washing the filters, and some ten to fifteen minutes are occupied each time with the washing.

As now commonly operated, mechanical filters are used with a coagulant, and their success depends largely upon its action. A solution of aluminum sulphate is injected into the water in requisite proportion, as the latter approaches the filter, and the soluble organic and coloring matter and the bacteria, throughout the whole mass of water, are subjected to its influence, and are rendered more suitable for removal by filtration. In the best and most modern apparatus, settling compartments are provided as adjuncts to the plant, by which a large per cent. of the impurities is removed before the water reaches the filter. In the settling tank the water is subjected to a rotary motion, which hastens the precipitation of the aluminum hydrate and other impurities held in suspension. Oftentimes seventy-five or eighty per cent. of these are removed in this chamber. This is brought about by the water entering the compartment in a tangential direction, which gives it a rotary motion about the center of the tank, which motion assists coagulation and separation. As the water passes into the tank it is kept to the outer edge by the centrifugal force due to rotation, but it gradually reaches the center by displacement, where it is gradually taken by an upright central pipe to the filter bed above. In some tanks the water is kept under the action of the coagulant from thirty to sixty minutes, although continuously passing toward the filter.

A filter operates more rapidly when fresh than after it has been in use for some time, and the amount of water that passes gradually becomes less as the filtration continues, until a condition is reached when washing is necessary. To overcome this variable rate, a controller has been adopted, which regulates the speed automatically and makes the rate uniform. When the standard height of water is reached and the maximum friction has been attained, the sounding of an automatic signal shows that the time for washing has arrived. With waters free from sewage, where the problem is mostly one of straining, a variable rate of filtration is generally satisfactory, but with sewage-contaminated waters, where the operation of filtration must be conducted with the greatest care, a uniform rate is far superior. For this purpose the controller is one of the most important adjuncts to mechanical filters.

There is a popular impression that when alum is used as a coagulant it remains in solution, and is necessarily drunk by those using the water. But such is never the case in a well-regulated plant. A water is never treated to its maximum capacity of decom-

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I. FROM CONGRESS STREET.

Showing Exchange and Devonshire streets on opposite side of State street, through which practically all teaming from freight centers across the city of Boston must pass.

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posing the coagulant, and when it is properly settled and filtered, it never has even a trace of the coagulant left in it. The logwood and acetic acid test is capable of detecting a mere trace of alum in a water, and yet, out of thousands of tests of filtered water where a coagulant was used, the writer has never been able to detect it. Popular fancy even is often taken as a fact, for in a recent investigation, where not a trace of alum existed in the filtered water, the writer was told that its astringency could be tasted, yet the logwood test, which was applied, is more than a thousand times as delicate as the sense of taste. I am not aware that there is a case on record where with mechanical filters any injurious effects have arisen from the coagulant used.

Mechanical filters are capable of purifying highly turbid waters, or those that contain suspended matter, like vegetable products and micro-organisms, and they are especially suited for manufacturing processes where clearness and freedom from color are important considerations. Their greatest success has been achieved in purifying water that contains an undue proportion of vegetable matter and micro-organisms. When it is considered that one hundred and forty cities and towns now purify their water by mechanical filters, supplying daily more than 227,000,000 gallons to their inhabitants, it is evident that this method of purification has long since passed its experimental stage, and is now fully recognized as one of the most successful means of purification.

COAL GAS AND WATER GAS.

By Alton D. Adams, M. A. I. E. E.

Coal gas is produced by heating bituminous coal in retorts or ovens from which the air is excluded, the gas being forced from the volatile portion of the coal. The gas is conducted away from the retorts as fast as it is generated, and is subjected to condensing and washing operations to fit it for illuminating purposes and to remove the tar, ammonia and sulphur it contains.

Coal gas retorts or ovens are heated by external fire, and no combustion takes place in them. Each retort usually contains not more than 300 pounds of gas coal at a charge, and may hold only one-half of this amount. The retorts, usually built of brick, in groups of from three to nine, are heated by fires of coke. From the small capacity of individual retorts for coal gas, and the number of coke fires to be kept up in a large plant, it seems that the item of labor must be large.

Coal gas contains a comparatively small part of the substance and energy of the coals from which it is derived, other products from the retorts being coke, tar and sulphate of ammonia. One ton, or 2,000 pounds, of good gas coal yields, on distillation in retorts, approximately 1,300 pounds of coke, 10,000 cubic feet of gas, 10 pounds of ammonia liquor and 7 pounds of tar. The 10,000 cubic feet of gas can develop about $650 \times 10{,}000 = 6{,}500{,}000$ heat units, or nearly one-fourth of the heating capacity of the coal. The coke has about 65 per cent. of the coal's heating power and the remainder, of 10 per cent., is nearly all represented in the tar and ammonia. An average of 300 pounds of coke is required to distill one ton of gas coal, but as this amount of coke represents only 17 per cent. of the energy of the coal treated, the net return from coal gas retorts is as much as 80 per cent. of the energy in the coal consumed.

In many cases the gas coals used do not yield a gas quite up to the figures above given for candle-power or heat units per cubic foot, while in some places a gas of more than 16 candle-power is desired. To increase the candle and heating powers of coal gas in these cases, a quantity of oil gas, or a rich gas from cannel coal is added, until the mixture has the desired qualities. At one dollar per thousand cubic feet, the gas from one ton of good gas coal has a value of ten dollars, and the average value of the residuals in the form of coke, tar and ammonia is one-half the total cost of coal.

Unlike coal gas, water gas is produced by direct combustion of the coal from which it is derived. Anthracite coal or coke is usually employed to make water gas, and the fuel put into the generator is entirely consumed or converted into gas.

The process of water gas manufacture, as usually carried on, has two distinct periods, during one of which the coal or coke is brought to a state of incandescence by its own combustion under a forced blast of air, then the supply of air is entirely shut off and steam is blown through the incandes-

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II. STATE STREET AT CONGRESS, DEVONSHIRE AND EXCHANGE STREETS.

One of the most difficult crossings in Boston. On account of Exchange street and car occupation of Devonshire street at this point, cross-town team travel is much obstructed.

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cent mass of fuel. The steam is decomposed into its elements, hydrogen and oxygen, the oxygen unites with the carbon of the fuel to form carbon oxide, and this gas passes from the generator, mixed with approximately its own volume of the liberated hydrogen. Now the heat required to decompose water is greater in amount than that which is liberated when the oxygen of the water combines with carbon to form carbon oxide, so that the mass of hot coal or coke, in a water gas generator, is rapidly cooled after the steam is turned on, and a temperature of the fuel is soon reached, where gas is no longer generated. Steam must next be excluded from the water gas generator, and the fuel again raised to a state of incandescence by a blast of air. Water gas manufacture is thus an intermittent process, carried on by alternate supplies of air and steam to the fuel in the gas generator.

In the best practice, approximately 40 pounds of coke are consumed in the generator for each one thousand cubic feet of plain water gas produced, and the fuel used to make steam brings the total amount, per thousand feet of gas, up to nearly 55 pounds of hard coal or coke. Allowing 13,500 heat units per pound for the fuel consumed in the generator, and 325 heat units per one thousand cubic feet for water gas, the gas is found to contain a portion of the fuel energy represented by $(325 \times 1{,}000) \div (13{,}500 \times 40) = 60$ per cent. Considering the net result from all of the fuel consumed in a plain water gas plant, the showing is not so good, as then the ratio of the energy in the gas produced to that of the coal or coke consumed is found from $(325 \times 1{,}000) \div (13{,}500 \times 55) = 43$ per cent.

Because of the comparatively low per cent. of the energy of fuel made available in water gas, its low heating power per cubic foot, and its lack of illuminating properties, the plain gas is but little distributed for public use. Carburetted water gas, on the contrary, is very largely made for general distribution, and its use is probably increasing faster than that of any other at the present time. Twenty years ago nearly all of the large public gas plants and most of the small ones distributed coal gas extensively. Now much of this is changed. The greatest number of individual companies still manufacture coal gas, but the gas works that produce coal gas exclusively are nearly all confined to cities and towns, each having less than 50,000 population. Many large works make both coal and water gas and distribute a mixture of the two, which is found to give good results. More than 80 per cent. of the cities having more than 50,000 inhabitants are now supplied with carburetted water gas alone or mixed with coal gas.

Carburetted water gas is produced by the introduction of petroleum or naphtha into the plain water gas, directly after it leaves that part of the apparatus in which the mass of hot fuel is located. The heat to which the naphtha or gas oil is subjected changes it to an oil gas, and it mixes with the plain water gas. The proportions by volume of water and oil gas, in the mixture called carburetted water gas, vary with the amount of oil used per thousand feet of gas produced, but with thirty pounds of petroleum for each one thousand feet of the total gas generated, the proportion is approximately one-third oil gas and two-thirds plain water gas.

Allowing 20,000 heat units per pound for the petroleum, the total heating power of the quantity consumed, per one thousand feet of the mixed gas, is $20{,}000 \times 30 = 600{,}000$ heat units, and of this amount about 80 per cent. or $600{,}000 \times .80 = 480{,}000$ heat units remains in the gas. In one thousand cubic feet of carburetted water gas the total heating power is, therefore, $480{,}000 + (325 \times 670) = 697{,}750$ heat units, or 697 per cubic foot, where the amount of oil used is that named. As much as 10 per cent. of the weight of oil used is recovered as tar, so that the total energy made available from the oil, per thousand feet of carburetted water gas produced, is $600{,}000 \times .90 = 540{,}000$ heat units. The coal consumed, per thousand feet of the mixed gas, yields in the gas $325 \times 670 = 217{,}750$ heat units, and the total energy from both coal and oil amounts to the sum of $540{,}000 + 217{,}750 = 757{,}750$ heat units. It has been shown that the total energy of all the fuel consumed in the production of one thousand feet of plain water gas amounts to $13{,}500 \times 55 = 742{,}500$ heat units, and the 670 feet required to be mixed with oil gas to make one thousand feet of carburetted gas, require $742{,}500 \times .67 = 497{,}475$ heat units in coal or coke. In a plant making carburetted water gas, the energy of fuel as oil, coke and coal, consumed per one thousand feet of gas produced is the sum of $600{,}000 + 497{,}475 = 1{,}097{,}475$ heat units. Dividing the heat available in one thousand feet of gas and the tar by-product, 742,500 heats units, by the number 1,097,475, gives the net efficiency of the carburetted water gas plant as 68 per cent.

A large per cent. of the gas now distributed in Boston is produced in Otto-Hoffmann ovens. These ovens are similar in some re-

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III. DEVONSHIRE STREET BETWEEN STATE STREET AND ADAMS SQUARE, BOSTON.

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spects to the ordinary gas ovens or retorts, but differ widely from them in details. Ordinary gas ovens each hold 300 pounds of coal at a charge and complete its distillation in about five hours, while the Otto oven takes 12,000 pounds of coal at a charge and retains it during about twenty-eight hours. Otto ovens are heated by external gas fires, the usual gas ovens by coke fires. It is well known that the ordinary gas-house coke is rather soft and not well suited to metallurgical purposes; the coke from Otto ovens is said to be of a much finer structure and well adapted for any use. The large element of hand labor, present with regular gas ovens, is much reduced with those of the Otto type, where the handling of coal and the removal of coke is done by machinery. Gas production in the Otto ovens goes on so slowly that the richer gas that is first given off may be readily separated from the poorer gas that comes later. The richer or first run of gas from Otto ovens has a higher candle power and more heat units per cubic foot than ordinary coal gas. Owing to the differences between the operation of ordinary gas ovens and those of the Otto type, the latter make available a larger per cent. of the total energy of coal than do the former.

Three hundred Otto ovens have been in operation at Boston during some months and regularly treat 1,500 tons of bituminous slack coal each twenty-four hours, 250 ovens being emptied and filled regularly during this period. The net daily products from this 1,500 tons of coal are 1,000 tons of coke, 67 tons of tar, 16 tons of ammonia sulphate and 4,500,000 cubic feet of 18 candle power gas. From one ton or 2,000 pounds of coal the yield is, therefore, 1,333 pounds of coke, 90 pounds of tar, 21 pounds of ammonia sulphate and 3,000 cubic feet of 18 candle power gas, having nearly 700 heat units per cubic foot. Allowing 13,000 heat units per pound for the coke, 20,000 for the tar, and 700 heat units per cubic foot for the gas, the total heating capacity recovered from one ton of coal in these Otto ovens amounts to 21,229,000 heat units. The coal from which these products are obtained has been found to contain 12,400 heat units per pound, so that the efficiency of the distillation is represented by $21,229,000 \div (12,400 \times 2,000) =$ 85 per cent.

The total amount of gas obtained from the coal in the Otto ovens named, is about three times the cubic feet above given, but the poorer gas is at present used to heat the ovens. For the entire run of gas the average is about twelve-candle power, or from 500 to 600 heat units per cubic foot, and this gas can readily be enriched up to the point required for illuminating purposes by the use of oil. Producers are now being erected in connection with the Otto ovens at Boston, so that a part of the coke made may be used to generate producer gas to heat the ovens, and all of the coal gas from ovens be sold eventually. This plant of Otto ovens at Boston is believed to be the only one of the kind in the United States, except a much smaller plant in Pennsylvania.

Comparing the several processes of gas production for public distribution, as to their ability to return the energy of the fuel used, the foregoing shows the efficiencies to be for oil gas, 47, coal gas, 80, plain water gas, 43, carburetted water gas, 68, and Otto oven gas, 85 per cent. It should be noted, however, that water gas represents the entire product of its coal, oil gas and carburetted water gas all of the available energy except that in a small amount of tar, while ordinary coal gas, as well as the Otto oven gas, does not constitute more than 30 per cent. of the distillation products, as to heating power.

The strong argument that has been put forward for carburetted water gas is that it represents nearly the entire result of its process. With this point in view, many large plants produce a mixture of coal and water gas, using the coke from gas ovens in water gas generators. As there is ample demand for a good grade of coke and as the total amount of gas required for public distribution must continue to consume only a small portion of the coal mined, it may be questioned whether coal gas processes, supplemented to some extent with oil, will not ultimately have the preference over the inefficient water gas process. The Otto ovens simply represent one of the improvements now taking place in coal gas manufacture, and it seems probable that they and other means to reduce the large labor item and to improve the quality of coke at coal gas ovens will receive more general attention from this time forward. Gas coals are a much cheaper source of gas than is petroleum, and the rapid extension of electric lighting makes it probable that the demand for a high candle power gas will decrease as the gas is applied more and more exclusively to heating and power purposes. If a gas of 20-candle power must be had, however, coal gas furnishes a base of much greater heating and illuminating power than does water gas. As has been shown, about 0.7 of the heat energy and nearly all of the illuminating effect of car-

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IV. DOCK SQUARE OPPOSITE EXCHANGE STREET, BOSTON.
By cutting off corner building a good entrance into Union street would be made.

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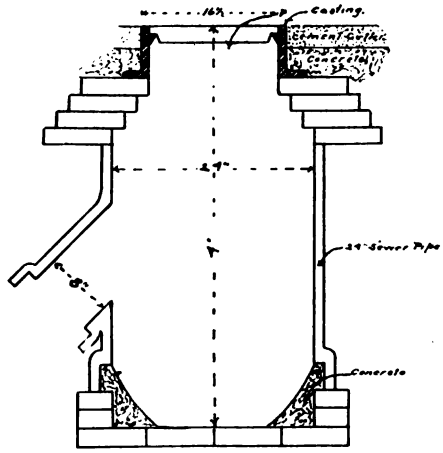
buretted water gas is due to the oil used in in it. For coal gas the heating power need be only 0.2 and the illuminating effect 0.2 to 0.4 due to oil. It is held that coal gas can not be enriched to more than 20-candle power without smoking, but a large part of the gas now distributed is not above that figure, the highest candle power having any extended use being about 25. High candle gas has been introduced to compete with the electric light, rather than to meet a public demand. The general requirement at this time is not for higher candle power, but for cheaper gas, and this can best be met with coal gas of less than 20-candle power.

A SEWER INLET PLAN.

By H. M. Miles, City Engineer, Michigan City, Ind.

In the construction of street pavements, one of the most important questions to be considered is the sewer inlet to receive the surface drainage. There are numerous patented inlets which are more or less satisfactory, but they are all expensive arrangements, some of them requiring, in addition to the inlet, the construction of brick catch-basins, while others are designed to connect directly with the sewer, allowing the sand and street washings to enter the sewer.



Engineers agree in condemning the catch-basin, from the sanitary point of view. As generally constructed they are merely large receptacles for all the filth of the street, which accumulates in the basins, there to remain for weeks and often for months, sending forth obnoxious odors and breeding disease, until such time as a force of men makes its appearance on the street and throws out a cart load of filth from each basin.

While some engineers prefer to let the street washings enter the sewer rather than to construct catch-basins, for the foregoing reasons, I do not think it advisable to do so, especially where much sand is liable to enter the sewer, and where the grade of sewer is not very great.

The accompanying drawing shows the manner of constructing the sewer inlets for our street improvements made the past year. They have proven highly satisfactory. It will be seen that they are made on the principle of the catch-basin, but, instead of being large and calculated to hold the accumulations of weeks, each inlet is provided with its own basin, the depth of which is about four feet from top of inlet. The inlet proper, or top, is provided with an adjustable cover and the street-sweepers are provided with what, for want of a better name, we call a spoon, made somewhat similar to a hoe, with which, after removing the top, they clean the basin with a very small amount of labor. Each street-sweeper is instructed to keep the basins clean as well as the street; and the ease with which they are cleaned has been the means of giving us as clean basins as we have streets. In this way all the objectionable features of the catch-basin have been overcome, and, at the same time, the sand and silt from the street is not washed into the sewer.

Another feature that must not be lost sight of is the cost. When it is taken into consideration that an up-to-date street intersection, with raised crossings, so there is no stepping down into gutters to cross the street, requires sometimes as many as ten inlets at an intersection, it will be found that the sewer inlets form quite an item of expense. The cost of this inlet, basin and all, complete, is less than the cost of most of the patented inlets alone.

This basin, as will be seen in drawing, is made from a twenty-four inch vitrified sewer pipe, set vertically, with an eight inch Y branch, resting on a brick bottom and topped off with brick, upon which the casting rests. An eight inch pipe leads from the Y to the sewer. There is no trap, the sewer

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V. MERCHANTS' ROW FROM STATE STREET, BOSTON.

Next cross-town street below Exchange and Devonshire streets. Narrow outlet into North street is shown. In addition Faneuil Hall Square is obstructed on week days by market teams.

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being thoroughly ventilated by means of the inlets. The bottom being made somewhat concave, instead of flat, by a ring of cement mortar or concrete around the bottom of basin, greatly facilitates the cleaning of the basins by the process before mentioned. There was some doubt in my mind as to whether they would be sufficiently strong, but when the steam roller ran back and forth over them, without the least sign of injuring them, all fears in this line were dispelled.

PARK DEVELOPMENT IN ESSEX COUNTY, NEW JERSEY.

The park systems of Newark and the adjoining cities and towns in Essex county, New Jersey, have been placed in the hands of a park commission of five members holding office for five years, one term expiring each year. The money for developing the systems is obtained from $1,500,000 of bonds voted by the citizens of Essex county, under a provision of the legislature passed in 1898. A question regarding the legality of the election delayed the completion of the plans and the commencement of serious work on them until late in 1898, so that but one season of work is reported upon in the last report of the commission.

The plans of the landscape architects, Olmsted Brothers, are given in this report. They include the improvement of Branch Brook Park, containing two hundred and seventy-seven acres in a long, narrow strip, averaging a little more than a thousand feet in width, cut into three divisions by natural and artificial obstructions, and extending through thickly settled parts of the city. East Side Park is a small rectangle of about twelve and one-half acres, a view of which in its present state is shown by one of our illustrations. Some gymnasium and toilet buildings are proposed, but no steps have as yet been taken toward their construction. When the trees and shrubbery have attained their growth the beauty of the plan of improvement will be disclosed. West Side Park, of twenty-three acres, and Orange Park, of forty-seven acres, are other local parks, and Weequabic Reservation, of two hundred and sixty-five acres, is one large enough for adequate treatment, and less than two miles from the center of population of the southern part of Newark. Eagle Rock and South Mountain Reservations are farther removed from centers of population and susceptible of less formal treatment than the other parks mentioned, it being possible to leave large areas practically in a state of nature. The parkways included in the general plan are still under study and will be located and developed as funds allow.

Cyrus Peck is the president of the commission, the other members being Franklin Murphy, Geo. W. Bramhall, Frederick M. Shepard and Eugene Vanderpool. Alonzo Church is the secretary of the commission; Howard J. Cole, the engineer in chief, and William S. Manning, the superintendent. The offices of the commission are in Newark

EDITORIAL COMMENT.

Concrete for Underground and Exposed Structures.

At the recent convention of the Association of Railway Superintendents of Bridges and Buildings, held in St. Louis, a committee presented a discussion of the general question, "Is concrete a suitable and economical material for bridge piers, abutments and railway culverts and arches?" It was participated in by letter by forty-three persons, most of them connected directly with railway work. Twenty questions had been asked by the committee and the letters answered and discussed these questions. The nature of these questions is such that almost the entire report is of direct value to all users of concrete. Some consideration of the various answers will be given in this and subsequent numbers of MUNICIPAL ENGINEERING.

To the first question, "Have you used, or are you using, Natural or Portland cement concrete in building foundations, retaining walls, dams, culverts, bridge piers or abutments, or similar structures?" there were forty replies stating that concrete is used in one or more of the structures named, and three stating that none is used. Twenty-one use both Natural and Portland cement; thirteen use Portland cement only, one (Canadian) uses English Portland only, two use natural cement concrete only, one of these only in foundations, and four do not specify. Five specify American Portland cement.

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VI. TREMONT STREET, BOSTON, FROM PARK STREET, LOOKING NORTH, SHOWING SURFACE CARS, TRACKS AND WIRES.

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The second question asks the class of structures in which natural cement concrete is used. The general practice is to use it only in foundation work completely enclosed. A few have used it in exposed situations and one in foundations, with poor results, and have abandoned its use. One uses it under water, another where there is not much water, another where the water is not running, another in fresh water only, stating that salt water ultimately dissolves out natural cement. Only four use it in work exposed to the weather and these only in work of secondary importance.

The proportions of materials used in natural cement concrete by the twenty-two persons reporting vary from one part of cement, one and one-half parts of sand and three and one-half parts of broken stone, to one part of cement, three of sand and six of broken stone. The most popular mixtures are one, two and four respectively, used by six persons, and one, two and five used by five persons. Three use gravel or broken stone, one using three parts of gravel as an alternative for four parts of broken stone. One uses gravel only in the proportions of one, two, and six or nine according to service required. One road uses the proportions one, two and four and one-half, if crushed sand rock is used; when crushed limestone is used the amount of stone is increased to five parts. One has used in some cases, with success, a mixture of one part cement, two and one-half parts sand, three parts gravel and four parts broken stone.

Mr. J. A. Snow, of the Boston and Maine Railroad, follows the principle that the amount of sand to be used must depend upon the proportion of voids in the stone or gravel used, since the voids must all be filled, and any excess is a source of weakness. The amount of cement to be used depends upon the strength of concrete desired. This is the true principle, and the most popular mixtures approximate to it quite closely, with ordinary materials. The variable proportions of gravel used by some are determined by the size and uniformity of the material. Screened broken stone is usually more uniform as to proportion of voids and hence the proportions are more nearly uniform.

Very few roads have fixed specifications for cement, notwithstanding it is the most important material in concrete. Eight have a natural cement specification. The requirements for tensile strength of neat cement mortar have considerable variation. Three require 50 pounds in one day, two each 60 and 70 pounds and one 75 pounds. The six requiring 7-day test are distributed from 90 pounds to 130 pounds. Two require 28-day test at 147 and 150 pounds. One requires 50 pounds in one day and 120 pounds in 7 days for mortar of one cement and one sand. Four specify test on mortar of one cement and two sand, two requiring a one-day test of 20 to 27 pounds, four a 7-day test of 35 to 40 pounds and three a 28-day test of 56 to 70 pounds. Six require a fineness of 88 to 95 per cent. on a No. 50 sieve and one 75 per cent. on a No. 100 sieve. Six require the cold pat test of soundness. Only one requires a test of time of setting, not less than 25 minutes initial and 50 minutes final. He also requires 300 pounds weight per barrel.

The general conclusion seems to be that natural cement concrete is not reliable unless completely enclosed and protected from the weather, especially the frost. Those discussing the question in detail think that a better result at but little, if any, greater cost can be obtained by varying the proportions of Portland cement to be used with the duty required of the concrete, on the principle cited by Mr. Snow. This reasoning does not appeal to all those using the better grades of natural cements for foundations and hearting, especially those who are able to procure these cements at a low cost for transportation.

Problems of Municipal Ownership. Several valuable discussions of questions relating to municipal ownership or control of franchise rights were presented at the recent meeting of the League of American Municipalities in Charleston. Prominent among these were two upon the subject of the remuneration to cities for franchise rights in, over, and under public streets and alleys by Charles W. Tooke, of the University of Illinois, and by Bird S. Coler, Controller of the city of New York. They discuss the question from the theoretical standpoint and from that of the actual granting of franchises in Greater New York. They are very valuable singly and particularly when studied in conjunction. Full abstracts of the papers will appear in MUNICIPAL ENGINEERING. Other papers on various phases of the main question were presented. Special mention is made of the following: "Public Water Supplies," by Mayor George R. Perry, of Grand Rapids; "The Municipal Electric Lighting Plant at Wallingford, Conn.," by Thomas C. Perkins, to be presented later in our pages. Mayor J. A. Johnson, of Fargo, N. D., discussed the contract system for street improvements, deciding in favor of it. Other

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VII. TREMONT STREET, BOSTON, FROM WEST STREET, LOOKING NORTH. FREE FROM TRACKS, CARS AND WIRES.

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valuable papers upon questions of municipal government were presented, the nature of which is shown by the notes taken from them for our news columns. The papers mentioned are deserving of careful study. All are highly practical and give definite answers for given conditions to some questions which are asked almost daily by interested municipal officials. Thus Mayor Perry's paper gives concrete examples of observed normal use of water to show the enormous waste in his city, and other examples of the effect of meters in reducing such waste. Mr. Coler's paper quotes the provisions of existing franchises in his city which he commends to other municipalities as being based upon right principles, though not applicable *in toto* under different conditions. A commendable tendency toward practical detail of application of the theories which have been developed is to be observed in nearly all the recent prominent discussions of municipal questions.

Oiled Roads. A paper by Mr. T. F. White, before the Good Roads Association of Southern California, gives a graphic account of the difficulties met in treating roadways of different materials. The persistence exhibited and the ingenuity in devising methods to suit the circumstances deserve the fairly satisfactory results obtained. The principal point developed is that the proper use for the oil is not to lay the dust, but to form, with proper surface material, an approach to an asphaltic surface, which is compact and somewhat elastic, thus forming a surface reasonably durable under ordinary country road traffic, smooth and solid. The complaint from roads where oil is used merely to lay the dust has been that the oily surface dirt is lifted by the wheels and is more injurious to vehicles, clothing and wagon contents than the dust it is intended to alleviate. A road, compacted with a roller as thoroughly as Mr. White proposes, with the excess of oil covered with a light sprinkling of fine gravel, and kept in repair, can scarcely have this objection.

The fact that Mr. White secured so satisfactory a surface from the use of a layer of clay, treated with oil in the manner he describes, suggests that a similar treatment of the surfaces of roads in the prairie states may be an inexpensive way of improving them. In many cases the present surface material could be treated successfully, while in others it may be necessary to bring in suitable material, which can be found in the immediate neighborhood. The sprinkling of gravel which seems to be desirable for the best results requires but a small quantity, and the expense for it is, therefore, light.

Chino is exceptionally well located for procuring hot oil cheaply, but one hundred and fifty barrels of oil to a mile of eighteen-foot roadway makes the first cost much less than the cost of gravel or broken stone, which must be hauled, perhaps, more than a hundred miles, and the cost of construction is apparently not more than that of a gravel road.

Mr. White's paper is commended to the consideration of the advocates of good roads in such a state as Illinois as a guide to a possible solution, at least in part, of their great problem.

It has been suggested that a very inexpensive bicycle path could be constructed by a similar method. The action of oil on rubber and the injury oily road material would do to the clothing of riders requires thorough protection of the oily surface with fine rolled gravel or stone screenings.

In both cases, but especially for prairie roads, the oiled surface acts largely as a roof to shed the water from the roadbed, and thus prevents the wheels cutting into it. This effect will be lost if the roadbed is not thoroughly drained. The partially elastic surface formed with the oil is not strong enough to prevent this cutting if the soil underneath is softened by water soaking into the sub-grade.

Proposed Experimental Septic Tank. The desirability of some purification of the sewage of Washington University and its accompanying buildings at the new location of that institution suggests to Professor Van Ornum the propriety of arranging the tanks and apparatus in such manner that experiments may be carried on with the purpose of working out the details of the operations and further developing the principles upon which the work of the septic tank is based.

In a paper on the subject recently presented to the Board of Directors of the university, Professor Van Ornum gives quite a full statement of the present understanding regarding the processes of sewage purification in which the septic tank is a step, and proposes a plan for the experimental tanks and apparatus. The actual first construction will cost comparatively little in addition to the necessary outlay for a purification plant equal to the best according to our present knowledge. The real expense will be in making desired reconstruc-

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VIII. TREMONT STREET NEAR BOYLSTON STREET AFTER REMOVAL OF TRACKS AND WIRES.

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tions for experiments, the plans for which will develop as the work goes on. There will be, also, a considerable expense in carrying on the daily routine of examinations, much of which can probably be charged to the department of instruction in the university since it may be made to form an important item in the training of students in some departments.

It is very desirable that such an experimental plant be established, and if the University board can see its way to appropriating the necessary money from time to time it will be doing a service to sanitary science and at the same time placing the University high on the record of promoters of scientific investigation.

In this connection attention should be called to the experiments on septic tank action in progress under the direction of the Massachusetts State Board of Health. Some account of the work in 1899 as reported upon in the last annual volume issued by the board will be found in our columns next month.

A Valuable Report. The Report of the Seventh Annual Convention of the American Society of Municipal Improvements, held at Milwaukee, in August, has just been issued by the Secretary, Mr. D. L. Fulton, of Allegheny, Pa. It is a volume of more than four hundred pages and contains a very valuable series of papers and discussions in which the readers of this magazine are directly interested. Many of these papers have appeared in our columns, but there are several lengthy compilations of forms, charter provisions and data on various subjects which are deserving of a prominent place in the engineer's reference library.

Among the questions discussed at the meeting were uniformity in municipal accounting and reports, and a concert of action among societies considering municipal matters. Progress was made in both these lines. A committee on the first subject, including also the matter of national statistics, was appointed to continue the work of two former committees on these subjects, and to confer with similar committees from other societies, that strength may be added to the movement by unity of purpose and concerted action.

The committee consists of Captain H. C. Newcomer, of Washington, D. C., F. W. Cappelen, of Minneapolis, Minn., and the editor of this magazine as chairman, a duty which has been imposed upon him for several years. Active interest in these questions has almost been confined to the members of the committees on the subject, with the exception of one or two societies, yet the needs of municipalities are recognized each year by more persons in position to secure some practical advance.

It is to be hoped that the suggestion made by this society regarding joint meetings with other societies considering allied subjects will bear fruit. A fair share of the half dozen or more societies which belong to the same class could combine, at least to the extent of holding their meetings at the same time and place, to the great advantage of all. If the National Municipal League and the Society of Municipal Improvements decide upon the same time for the next meeting at Niagara Falls, it will be both a pleasant and a profitable thing for the League of American Municipalities to change its place of meeting and fix upon the same time.

Public Lighting. The last issue of Municipal Affairs contains a valuable symposium upon the subject of public lighting. It opens with a paper upon state control of corporations by James Blake Cahoon, followed by a history of the work of the state gas commission in Massachusetts. This state has been a storm center of the gas field for years, and the attempts to evade the strict provisions of the law placing certain acts of lighting companies under the control of the commission have been numerous, and have led to a number of modifications in the law. The experience thus gained is invaluable and will serve as an indication of the proper procedure in other cases, when the present agitation of the matter of municipal or state control of public service industries reaches the stage of action. The conclusions drawn in this paper are, that uniform systems of accounts are necessary, that rates should be regulated rather than competitive companies admitted, that capital should be limited to actual value of property: that the ownership of stock of companies by foreign or domestic corporations or voluntary associations should be prevented.

Mr. Milo Roy Maltbie makes a comparison between the conditions under private ownership and under public ownership in Great Britain. Mr. E. J. James sketches the progress in the city of Halle in Germany, Mr. Ricardo Bachi in Italy, and Mr. John A. Fairlee in Detroit, Mich. While the conclusions to be drawn from the statements in three of these papers are, as usual, not absolutely reliable, on account of the practical impossibility of taking full account of all the

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IX. WASHINGTON STREET, BOSTON, NORTH FROM CLIFTON PLACE, WITHOUT ELEVATED RAILWAY STRUCTURE.

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circumstances of every case, the tone of discussion is so temperate and the claims made are so moderate that they may be accepted as very satisfactory statements of the side of the case to which the authors have been led by their studies, for all the last four papers mentioned are upon one side of the question and are favorable to municipal ownership of lighting plants for supplying both municipalities and private consumers.

Some of the questions raised will be considered more in detail from time to time. It is sufficient to call attention at this time to the value of the statistics and reports of actual transactions which are presented in the papers composing the symposium.

ANSWERS TO QUESTIONS.

PLANTS FOR SEWAGE DISPOSAL BY CHEMICAL PRECIPITATION.

Can you give me any information concerning towns of three or four thousand population which have plants for treatment of sewage by chemical precipitation using lime and alum?

George D. Jenkins,
Waynesboro, Pa.

A number of small towns have constructed such plants; some of which are still in use. Descriptions of them and of their condition at the time the book was prepared will be found in Rafter & Baker's Sewage Disposal in America ($6). Round Lake, White Plains, Chautauqua, New York, Worcester, Mass., have plants varying in size from small to large.

ADDITIONAL HOT WATER HEATING PLANTS.

We contemplate a hot water heating plant for the business portion of our thrifty little city of 4,277 population, with about 3,500 feet of pipes and perhaps 100 patrons. We are looking for information as to the best system and the size necessary.

R. M. & W. J. Johnson,
Wicomico Falls Light and Power Co.,
Salisbury, Md.

The table given in the December number of MUNICIPAL ENGINEERING, on page 413, will give much of the data desired. But two systems are used in any of the cities included in the table -the Evans and the Yaryan. The former has been in successful use on smaller scale than the works described for a number of years. The latter was first used in 1896. The central heating project is as yet too young to have solved all the problems of detail which arise. Most of the plants use the exhaust steam from electric light and power plants for heating the water so that but little additional boiler capacity is required. Our advertising columns contain information on the subject. The following should be added to the table referred to above:

Iowa Falls, Iowa, uses the Yaryan system which was installed in 1899. The hot water is sent out at a temperature of 140° to 200° and returns at 125° to 180°. The distance water is carried is 2,000 feet, 1,000,000 cubic feet of space are heated and the charge is 15 cents per square foot of radiation per year.

Perry, Iowa, uses the Yaryan system, which was installed in 1899. The hot water is sent out at 160° when the weather is at freezing point, and returns at 135°. The distance the water is carried is ten blocks or 3,700 feet, 50,000 square feet of radiation are in operation at a charge of 15 cents a foot per year. A. L. Hindert is the president of the Perry Electric Light, Power and Heating Company.

PROCEDURE TO SECURE PROPER RECONSTRUCTION OF STREETS BY RAILWAY COMPANY.

The common council of this city some time ago granted the Cincinnati, Lawrenceburg and Aurora Electric Railroad permission to lay its tracks and run its cars upon certain streets under certain conditions and restrictions, among which were, to lay its tracks with existing or any other established grades, to so construct the tracks as not to interfere with travel over or along the same, to replace the streets after laying its tracks in as good condition as they were before they were broken up by it and to keep them in good condition, using such material as is or may be used by the city on the same streets. There is a provision in the franchise that if said company fails to comply with any of its requirements it shall be forfeited. The company has utterly failed to comply with the requirements of the franchise in regard to streets. What have other cities done in such cases?

W. H. Bainbridge, City Attorney,
Lawrenceburg, Ind.

Frequently there is some provision in the franchise under which it is possible for the city to do the necessary work, or to let it to a contractor, and the city, or the contractor, can collect the cost from the railway company. This may be possible here. In case it is not, the next step may be to declare the franchise forfeited under its provisions. An attempt to make this declaration operative and recover control of the streets, may secure the desired repairs. In some cases the railway companies have had confidence in their power to disregard the apparent pro-

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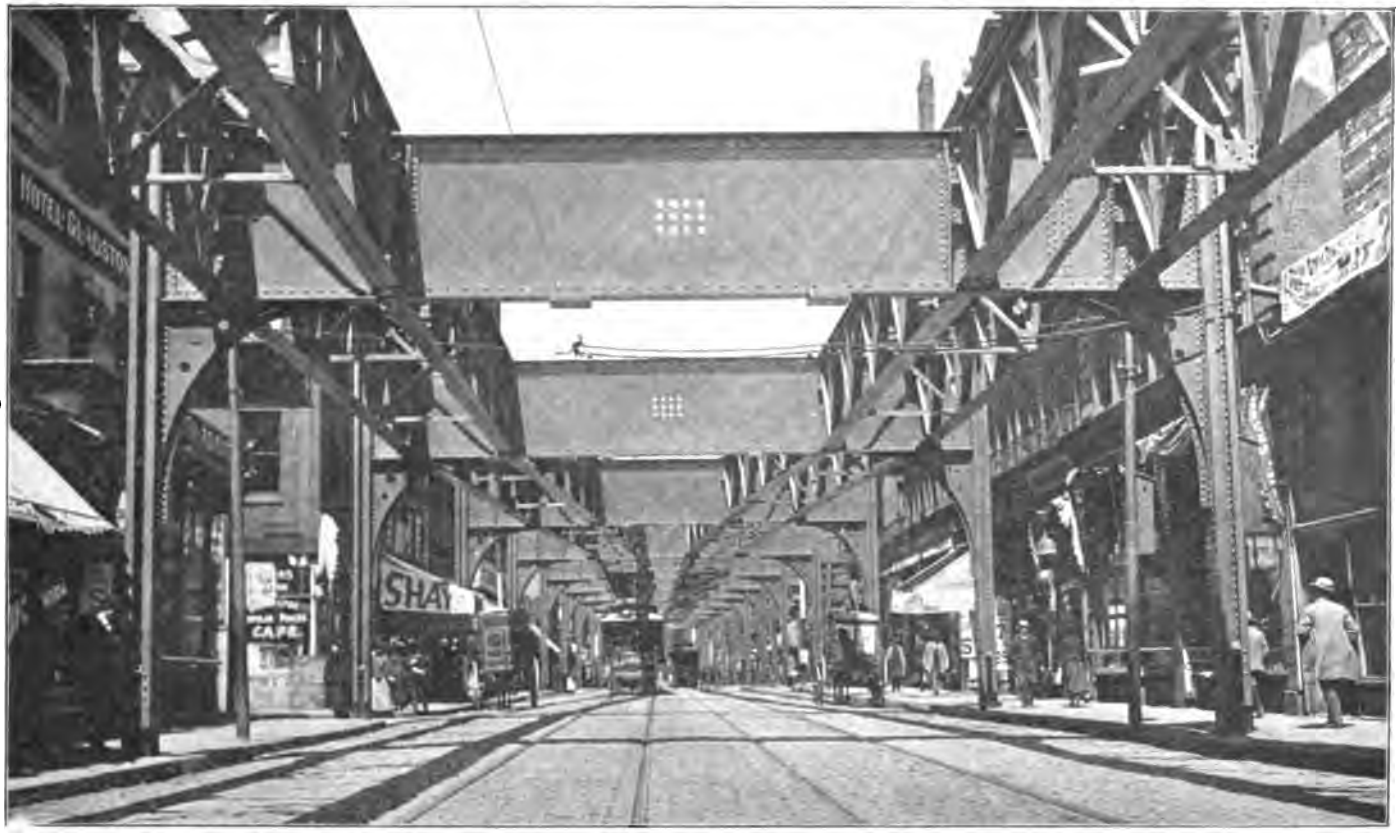

X. WASHINGTON STREET, BOSTON, NEAR DOVER STREET, SHOWING ELEVATED STRUCTURE.

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visions of the contract on account of its defective construction, and have instituted a legal contest. The best of legal advice is therefore necessary in deciding what steps to take. In some cases all that was necessary was a decision by the court upon the question of what was satisfactory performance of the agreements in the franchise, no other provision for settling this question having been raised.

INFORMATION ON SEWAGE DISPOSAL PLANTS.

We have been investigating the question of sewage disposal and wish to be referred to articles on the subject, and to cities where any of the various systems are in operation. *Samuel Amspoker,*
Washington, Pa.

There is scarcely a number of this magazine which does not contain articles upon this subject. Among the more important recent articles are the following: "Sewage Purification," by E. A. Hermann, p. 195, September, 1900; "Sewage Disposal and Water Purification," John N. McClintock, p. 199, same number; "Sewage Treatment in England," pp. 262 and 295, October, 1900, and p. 114, February, 1899; "The Champaign Septic Tank," by A. N. Talbot, p. 158, March, 1899; lists of books describing and of cities having plants, p. 213, September, 1900, and p. 414, December, 1900. See also answer to Geo. D. Jenkins above.

BOOKS ON ELECTRIC RAILWAY SURVEYS AND CONSTRUCTION.

Kindly inform us of the title of the best book you know on electric railway surveys and construction, one that goes into details thoroughly from surveys to track-laying and wiring? *Jackson & Knox,*
Parkersburg, W. Va.

Brooks' "Handbook of Street Railroad Location" ($1.50) gives the civil engineers' part of the duties of street railway construction, Dawson's "Electric Railways and Tramways" ($12.50) gives financial and engineering data as to design, construction, equipment and working, illustrating types of machinery and apparatus, and giving detailed descriptions of European and American railway installations. It is an English book. A second revised edition of Crosby & Bell's "Electric Railway in Theory and Practice" is now in press. Merrill's "Reference Book of Tables and Formulæ for Electric Street Railway Engineers" ($1) may be one of the books desired. Trevert's "Electric Railway Engineering" ($2), embracing practical hints upon power-house, dynamo, motor and line construction, was published in 1892. Municipal Engineering Company can supply any books desired.

BOOKS ON WATER PURIFICATION AND ANALYSIS.

Can you suggest some good works upon water purification and water analysis? Where can I get full report on these subjects made to the American Public Health Association?
W. H. Shillinglaw,
Architect and Civil Engineer,
Brandon, Man.

Hazen's "The Filtration of Water Supply" ($3), Baker's "Potable Water and Methods of Detecting Impurities" (50 cents), Mason's "Water Supply" ($5), are good books upon these subjects. Fuller's "Report on the Purification of the Ohio River at Louisville, Ky." ($10), is a complete discussion of slow sand and mechanical filtration of such waters and a guide to the necessary analyses. Wanklyn's "Water Analysis" ($2) is an excellent English book on the subject. Municipal Engineering Company can supply any books desired. Dr. C. O. Probst, Secretary of State Board of Health, Columbus, O., is the Secretary of the American Public Health Association, and can supply its reports.

CITIES USING N. B. M. A. BRICK TESTS.

What cities, if any, use specifications for paving brick which conform to the standards approved by the National Brick-Makers' Association, or meet those requirements approximately?
Ira H. Woolson,
Columbia University, New York.

An article by E. A. Kemmler, Assistant City Engineer, Columbus, Ohio, page 187, September, 1900, of MUNICIPAL ENGINEERING, states that the N. B. M. A. test was used for three years with unsatisfactory results. The results of one test under the new N. B. M. A. test, using foundry shot in addition to the brick, indicate that the modified test is very much more satisfactory. An article by A. N. Talbot, on page 235, April, 1900, gives a statement of the needed changes in the older N. B. M. A. tests. Another article in the same number describes a method of comparing the rattler tests. St. Louis has used a method approximating the N. B. M. A. program, but differing in some important particulars.

POWER FOR SMALL PUMPING PLANTS.

We are now pumping two wells by steam power in separate plants. We wish to drill a third well and run the three wells from one plant, if possible. The new well is 233 feet above tide. It is 2,143 feet from the first well, which is 373 feet above tide, and 4,500 feet from the second well, which is 440 feet above tide. Electric power can be obtained from a street car company. What methods are in use for such cases? Could compressed air be used?
Edw. L. Gernaud, President,
Mt. Washington W. W. Co., Baltimore, Md.

The ordinary small power pumping plants are run by steam, by gas or gasoline engines, by oil engines, by electrically driven

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BRANCH BROOK PARK, NEWARK, NEW JERSEY. EXCAVATING THE LAKE, 1899. See page 12.

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pumps and by the air lift. If it is not necessary to run the pumps all the time, the plant which wastes the least value of fuel in getting started, and after stopping, is the most economical. Mr. Freeman C. Coffin has prepared a table showing the relative cost of pumping various small quantities of water by oil, gasoline, gas and steam, which is given as the most satisfactory way of comparing the different methods:

Average Daily Pumping in Gallons.	Oil Engine, Oil 9 cents a Gallon.	Gasoline Engine, Gasoline at 9 cents a Gallon.	Gas Engine.		Steam Pump.		
			Gas at $1 per 1,000.	Gas at 50c. per 1,000.	Coal at $5 a Ton.	Coal at $4 a Ton.	Coal at $3 a Ton.
50,000	$770	$735	$920	$675	$1,230	$1,160	$1,090
100,000	1,275	1,200	1,580	1,035	1,740	1,600	1,460
200,000	2,200	2,050	2,815	1,820	2,525	2,300	2,075
300,000	3,085	2,875	4,000	2,510	3,130	2,850	2,570
400,000	3,920	3,640	5,140	3,150	3,700	3,350	3,000
500,000	4,745	4,400	6,270	3,780	4,200	3,790	3,380

It will be observed that for the smaller quantities of water pumped the gasoline engine is the cheapest, under ordinary prices, but that the relative economy of the steam engine increases with the increase in quantity of water pumped. The air-lift is not usually considered to be economical and is of limited application, but sometimes is the best method that can be adopted, under certain rather exceptional conditions. The economy of electrie power will depend upon the price paid for it, if purchased from the power company, and upon the capacity and economy of design of the plant, if one is constructed at the proposed new well.

All the methods suggested contemplate separate plants at each of the wells except the use of electricity and of compressed air. Unless steam is used one man can take care of three separate plants. Which would be the best plan under the special local conditions can only be determined by a study of them, with full knowledge of local prices for materials and labor, and the results of the study will be most satisfactory if the solution of the problem is entrusted to a competent and experienced engineer.

FLUSHING LARGE SEWERS.

Will you please inform me, through the columns of your valuable journal, whether or not automatic gates placed in large pipe sewers, say, from 15 inches to 24 inches diameters, have proven to be particularly advantageous in any of the cities of this country; and whether they tend to lessen deposit and offensive odors emanating from the man-holes of such sewers?

Any information you can give me concerning these gates, the manner of constructing and placing the same in the sewer, the usual material of which they are made and their general utility will be appreciated. If you know of any cities where they are in successful operation, please mention them. Also, if you can suggest some other satisfactory method of hand-flushing by means of sewage, and class of dam or gate used in man-holes for such purpose, please do so. And also please state the relative merits of the two systems of flushing by hand and by automatic gates. *Geo. C. Wimberly,*
City Engineer, El Paso, Texas.

No satisfactory automatic gates for use in large pipe sewers in flushing them by backing up the sewage are known to the writer. There are several methods of stopping the man-hole outlets until sufficient head is obtained to flush the sewer below. The most permanent is a gate running in a frame built into the man-hole, this gate being pulled up by hand, or one in the form of a water pipe with gate valve, according to the depth of water desired and consequent pressure on the gate. It is usually not possible to back up the sewage in the pipe to any great depth on account of causing it to flow into low cellars connected with the sewer. Collapsible plugs can be used, in the form of bags of water which collapse when the rope holding the mouth of the bag is withdrawn and are drawn out by another rope attached to the bottom of the bag; or a valve swinging on a central axis, which can be pulled up from the bottom easily, as the pressure to be overcome is only that between the top and bottom halves of the valve. The top half will not be water-tight. If water is introduced from outside for flushing purposes it will be desirable to plug both inlets and outlet of man-hole, using the amount of water the man-hole will hold, only. This may give better head, but will not give quite so long continued a flush. The frequent use of pills and other devices which have been described in this department several times will probably be more satisfactory than any of these devices.

Automatic flushing of such large sewers can hardly be satisfactory as they require personal attention to insure the proper removal of all the various kinds of deposits that are possible in a sewer laid on a flat

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EAST SIDE PARK, NEWARK, NEW JERSEY, LOOKING NORTHWARD, 1899. See page 12.

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grade. Deposits will also be formed while the sewage is dammed up, which will not be washed out when the gate opens.

TEST OF PURITY OF CEMENT.

As city engineer I have a large number of cement tests to make. Heretofore I have confined myself to the test for tensile strength, but lately I have been making a test to ascertain the amount of refuse matter in the cement.

I first weigh the cement, then mix thoroughly with water and carefully pour off the suspended cement and repeat until the water runs off clear. By this process all of the cement having any hydraulic properties whatever is removed and the remainder is of no more value than so much sand. This residue is then dried and weighed, and I find that it amounts to from 7 to 34 per cent. in the various brands of Portland that I have tested by this process.

I have never seen this test in print, but it appears to me to be the most simple and surest method of ascertaining the actual value of the cement.

Will you kindly give me your opinion of this method? *E. B. Banks, Superior, Wis.*

This test seems to give one of the results of the usual test for fineness. The residue obtained from washing out the finer particles is about the same as that obtained by running the cement through a very fine sieve. If the decanting of the turbid water is very carefully done, the residue is probably larger than that left on any of the ordinary sieves, even one of 200 meshes to the inch, but the exact amount of residue will depend upon the care with which the operation is conducted. The sieve test is quite as easily made and can be carried to any desired degree of accuracy short of the most careful manipulation of the water test. On the other hand the water test dissolves out the fine particles adhering to the larger particles remaining on the sieve. The amount of such fine material is almost infinitesimal, however.

On page 107 of MUNICIPAL ENGINEERING for February, 1896, Mr. L. C. Sabin quotes a different form of this water test which gives some additional qualitative information, but the results can not be expressed in figures. Instead of pouring off the water after the cement has been thoroughly shaken up in it, allow the cement to settle again without any disturbance, even the slightest. When the water has cleared, the coarsest cement will be found at the bottom and it will be carefully graded according to weight of particles. This will practically be according to fineness. Underburned cement will appear as the top layer and show a more yellowish color.

This test of fineness is a very desirable test to make, whether with the sieves or by means of the water test described. A dependence upon tests of tensile strength alone is not advisable. Cements with a considerable proportion of the inert residue will usually show higher tensile strength than the fine cement from which this residue has been sifted. A certain proportion of such inert matter, is, therefore, advantageous to the manufacturer, if tests of tensile strength alone are demanded. Still other tests should be made, according to the standard program of the American Society Civil Engineers. Dependence on a single test may lead to the acceptance of inferior cements, so selected as to pass the single test with a higher standing than better samples of the same brand.

LEGAL DECISIONS RELATING TO MUNICIPAL MATTERS

[By C. W. TOOKE, A. M., LL. B., for MUNICIPAL ENGINEERING.]

FRANCHISE RIGHTS—ACCEPTANCE BY A PRIVATE COMPANY ESSENTIAL.

The supreme court of Florida in Capital City Light and Fuel Company *v.* City of Tallahassee (28 S. R. 810) holds that under a franchise authorizing a private company to construct, maintain and operate a gas plant and an electric light plant to supply gas and electric lights in a certain city with exclusive privileges for twenty years, the franchise is divisible and that the construction and operation of the gas plant does not work such an acceptance of both parts of the franchise as to preclude the city under legislative authorization for erecting and operating an electric light plant of its own. The franchise in question called for a written acceptance by the company within thirty days from the passage of the ordinances, upon the filing of which with the city clerk, the ordinance was to become binding on both parties. The company was required to begin the construction of the gas-works within thirty days of acceptance and to construct the electric light works as soon as a sufficient number of consumers could be secured to pay 8 per cent. interest on the additional capital required to purchase the machinery for and put the plant in practical operation. As the company complied with every article of the agreement, the

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franchise would seem to be valid and binding in every respect.

The real ground for sustaining the right of the city to erect an electric light plant is one that applies with equal force to the erection of a gas plant, namely, that the statute under which the city acted did not give it power to grant any exclusive privilege to the use of the streets for the purpose of laying pipes or setting up poles and towers for furnishing either gas or electric lights. Upon this ground only is the decision defensible.

SPECIAL ASSESSMENTS. FRONT FOOT RULE SUSTAINED IN MISSOURI.

In Barber Asphalt Paving Co. v. French (58 S. W. R. 934), passed down by the supreme court of Missouri, Nov. 13, 1900, that court refuses to attach to the Norwood-Baker case the significance which has led several courts, both federal and state, to declare all assessments by the front foot which do not provide for a judicial adjustment of the amount to be paid to the benefits assessed, null and void under the Fourteenth Amendment of the Constitution. The decision displays great ability and is a masterly presentation of the case in favor of the view which it sustains.

The court reviews the Norwood-Baker case, and concludes that that decision properly includes only three propositions: "*First*, That due process of law, as used in the fourteenth amendment, requires compensation to be made to the owner of the land condemned for public use; *second*, that the exaction from the owners of abutting property of the cost of a public improvement in substantial excess of the special benefits received by him, is, to the extent of such excess, a taking, under the guise of taxation, of private property for public use without compensation; *third*, that in that case the special assessment upon the abutting property of Mr. Baker of the entire cost of opening the street, including not only the full amount paid him for the strip condemned, but the costs and expenses of the condemnation proceedings, was a taking of his property for public use without compensation; in a word, that while it was nominally an exercise of the taxing power, it was nothing less than confiscation."

The court holds that the decision must be read within the limitations of the facts of that specific case, and that the uniform line of decisions in Missouri must be followed until it is shown, beyond a reasonable doubt, that the supreme court of the United States holds a contrary interpretation of the constitution. The court concludes by stating its willingness to conform to the ruling of the federal supreme court whenever a decision on this specific point shall be rendered by it.

This decision of the court is undoubtedly based upon a conservative view of the case presented. As we have already pointed out the Norwood-Baker case is of more importance as indicating the principles to be applied to such cases in the future rather than to the narrow questions decided. The circuit courts of the United States and the supreme courts of some of our states have taken the liberal interpretation of that decision as the one to be followed. In a state like Missouri or Indiana, however, where the doctrine of assessment by the front foot has been thoroughly incorporated and has been upheld time and again, the courts can not do otherwise than abide by their previous decisions—and await a decision by the supreme court of the United States upon the exact question involved. On the other hand, we still believe, both on the ground of expediency and justice, that the influence of the Norwood-Baker decision upon the action of the legislator should be very different, and that no statute or special charter should be enacted granting a power of special assessment by the front foot to a city, unless provision is made therein for a judicial determination of the benefits to result from such assessment. The Norwood-Baker decision does throw a solid doubt upon the future action of the federal supreme court and a fundamental principle to be followed by the legislator is to keep within a due margin of constitutionality.

SPECIAL ASSESSMENTS IN ILLINOIS.

The supreme court of Illinois at its October session passed upon a point of general interest to all interested in the special assessment law of that state. The Illinois statute, which may well serve as a model enactment, authorizes special assessment on abutting property on account of local improvements only to the extent of special benefits, and makes express provision for the equitable apportionment of the cost between the city and the property benefited, and for a review of the assessment by the court prior to its final confirmation. Under this statute, the court holds that a prior determination by the city authorities that abutting property will be benefited to the extent of the entire cost of the improvement is valid, because the property owner is still

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assured of his right to be heard on the question of the apportionment according to the benefits received by the abutting property. A reading of this decision will convince anyone of the elasticity of a statute properly drawn, even under the most liberal extension of the Norwood-Baker decision. (Middaugh v. City of Chicago, 58 N. E. R. 459.)

ASSIGNABILITY OF OPTION TO PURCHASE GAS PLANT.

The supreme court of Kentucky, in Covington Gaslight Co. v. City of Covington (58 S. W. R. 805), was called upon to pass upon the power of a city to assign its right to purchase a gas plant erected under a municipal franchise. In the franchise granted by the city of Covington, the municipality retained the right of purchasing the plant, "at the expiration of each and every five years thereafter." Under the state statute the duty is imposed on municipal corporations to provide for public lighting, and to furnish light to their citizens in the best, cheapest and most improved manner. As the right to purchase was one consideration for the granting of the franchise, the city, under the broad powers given it by the statute, undoubtedly had the power to dispose of the option in any manner which, in its judgment, would promote its own interest and that of its citizens, provided no injustice was done to the company.

POWERS OF MUNICIPAL CORPORATIONS—CREATION OF MONOPOLIES.

In City of Atlanta *v.* Stein (36 S. E. R. 932), the supreme court of Georgia has declared void the ordinance of the city of Atlanta, which attempted to restrict the award of the public printing to union offices. While the largest discretion was given to the city authorities by the statute, the court very properly holds that an ordinance is in effect a law, and that the legislature can confer no power upon a municipal corporation that it could not itself validly exercise. As class legislation is contrary to public policy, the ordinance was adjudged invalid. The supreme court of Illinois has taken similar grounds, and the soundness of the decisions is unquestioned.

RIGHT OF CITY TO REMOVE POLES FROM ITS STREETS.

In Coverdale *v.* Edwards, (58 N. E. R. 495), supreme court of Indiana, the right of a city to remove the poles of a company which had a mere license to use the streets after the expiration of its franchise is affirmed. The city of Decatur in this case exercised the power of revocation granted to the plaintiff company, and, after notice to the company, ordered the city marshal to remove the poles. In a suit brought by the company against the marshal for such removal, the lower court instructed the jury to consider as elements of damages the destruction of the plaintiff's business, the loss of his lease of a power-house, and the difference in value between the poles, wires, and lamps, when standing ready for use and when torn down. The supreme court holds such instructions to be erroneous. After the expiration of the plaintiff's franchise and notice by the city directing the removal of the poles and wires, the continuance of the poles and wires in the streets was a nuisance *per se*, and the city had the right to order the marshal summarily to remove them. Acting under this power, the marshal could be held liable only for those damages resulting from a want of due care in effecting the removal, as for a conversion of the property.

GOOD ROADS AND THEIR BENEFITS.*

By T. F. White, Chino, Cal.

In San Bernardino county we commenced using oil on our roads last year. It being an entirely new thing and none of the board having had any previous knowledge of applying oil to roads, we contracted to have the work done, on from twenty-five to thirty miles. The idea was to keep the dust down; to use it as a substitute for sprinkling with water, and the contract called for a dustless road from May 1 to Dec. 1; the contractor agreeing to put on three applications of oil during the season. The results were, for the most part, satisfactory. But we have learned considerable since then and are still learning.

This spring we felt capable of doing the oiling ourselves, and put on one application—during June and July—which has given better results than the three applications by the contractor last year. The contractor's idea was to keep the dust down, so that he used only enough oil to

*Abstract of paper read before the Good Roads Association of Southern California.

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accomplish this; we have gone a step further, and while keeping the dust down, we have attempted to build up a surface on the road that will take the wear of travel. To do this requires a generous supply of oil in the first application. It is economy in the ultimate result, to put on all the oil in the first application that the surface of the road will take; the oil to be as hot as possible, from 200 degrees up.

We used from 100 to 150 barrels to the mile; and in places even more than that—applying it sixteen to eighteen inches wide. In putting on this quantity there were places that had too much oil, and other spots where chuck-holes had commenced to form, that had not enough. These spots were gone over again. On spots having too much oil, some dry dirt from the side of the road was thrown, or, if it was a graveled road, some fresh screened gravel was sprinkled on, just enough to take up the surplus oil and no more. On the loose spots requiring more oil, additional oil was run, and with shovel or hoe and rake it was thoroughly mixed with the loose material entirely to the bottom of the hole. This then packed down from the travel. For doing this we have what we call a "repair outfit," a tank holding from six to eight barrels of oil, set on a wagon gear, with a two-inch hose ten to twelve feet long extending from the tank, with a nozzle and cock on the end, and a cock on the outlet of the tank. The tank has a large opening on top covered by a cap through which can be lowered a bundle of brick or stone, heated by a fire alongside the road, for warming the oil in case repairs are made in cold weather. One man and two horses can manage the outfit. It can be used in working over loose spots in the road when making the first application of oil and subsequently in keeping the road in repair. The tools needed with it are a shovel, hoe and rake. Whenever a place in an oiled road commences to cut, the repair man should start with his outfit. In this way the road can be kept in good condition with comparatively little expense.

From our experience it is not advisable to apply oil on any roads except those made of a material having a firm consistence. Oil applied to a sandy road, or one formed of a loose, alluvial soil, will tend to keep the dust down, but will not make a satisfactory road. Such a road should first be surfaced with a firmer material and then oil applied. On the other hand, a road may have too light a surface to absorb oil. In that case the surface must be prepared to receive it. Our Mr. Glover of the Third district has a piece of road running out of Colton, made of Colton limestone, which he wished to oil. The surface was very hard and tight. He put a thin covering of sand over it, and then applied the oil, and got good results.

Should a road to which you wish to apply oil have become worked up before the oil is applied, and a thick layer of dust be over it, due perhaps to commencing the work late in the season, it may be well to scrape off the dust, or a part of it, with a grader or smoother before applying the oil. For all of the loose covering of the road must be thoroughly saturated, as well as a penetration of the hot oil into the firmer surface below secured—the deeper the penetration the better. Such roads can also be prepared by being shaped up with grader and smoother, thoroughly soaked with water and rolled hard. This has reference to roads that have not been oiled before.

I wish to speak more particularly of some experiments carried on at Chino, where I live and could personally look after every detail of the work. Every one who has been to Chino has probably noticed that we have a great deal of sand there. The surface is very loose. The teams in going through the village formerly plowed through the sand and loose alluvial soil, and before we laid sidewalks walking was difficult. But sand when confined becomes very firm and hard. So, if sand is covered with a firm material for the road surface, it makes an excellent foundation. Little had been done to improve the condition of our roads up to last year. It was thought there was no good material within reach. About two years ago a strip of road one-half mile in length west of Chino was surfaced with a clayey gravel, hauled from the hills about three and one-half miles distant, a material used years ago for making bricks. It was spread to a depth of a few inches over the road. It was not spread very evenly and there were thin places in it, but it wore well. The thin places soon broke through, however, and it was sticky in winter after a rain. When I came to take charge of the roads and cast around for some solution of the road proposition at Chino, I was attracted by the excellent wearing qualities of road material above referred to—when dry. A closer examination of it showed it be "oil sand," or disintegrated oil sandstone that we hear so much about in this "oil age" of California, with sufficient clay in its composition to cement it and make it very hard when properly treated. We had decided to use oil on our roads in the neighborhood of San Bernardino, Rialto, etc., and the thought occurred to me that we had in the Chino hills, which is an oil range, a material that, combined with oil, would make an ideal oiled road, for it would become very hard, had good wearing qualities and was a natural absorbent of oil. So I concluded to do a little experimenting on two of our village streets, about a quarter of a mile on each street.

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After grading, thoroughly soaking with water and rolling hard the foundation, we put on a layer 7 inches thick in the center, running down to 6 inches on either side, of the oil sand or gravel. (Since then in building such a road we make it 9 inches thick in the center, down to 8 inches on the sides.) We kept the foundation wet ahead of the spreaders, to keep it firm and cause the gravel to unite with it better. After the gravel was spread and smoothly shaped, we started the water carts and soaked it, thoroughly wetting it entirely through. To do this we ran a heavy orchard cultivator over it while the water was being put on. This opened it up and allowed the water to go down instead of running off. The cultivator was kept going after sufficient water was put on, until the surfacing material was worked into a homogeneous mass of the consistency of mud for making brick. The wetting down and cultivating or stirring was done in one day, a section of such length being taken that this part of the work could be finished in one day. Next morning a lever harrow was put on to smooth over and shape up the surface. This required a man with a good eye and some expertness to get the road even and properly crowned. He finished his work during the forenoon, and it being good drying weather, the roller went on in the afternoon. All these steps are important, but one of the most important is the rolling. We used a roller that weighs about 1,600 pounds to the foot of surface covered, without loading. This is about right for rolling such a road the first two days, or as long as it is at all spongy. As soon as all sponginess is gone the roller can be weighted. We use pig iron—half pigs—which are convenient to handle, and put enough on to make finally a weight of about 3,000 pounds to the foot. The rolling was continued from day to day until no further impression could be made upon it, and the surface was left hard and smooth.

After the roadbed dried out, or at least to a depth of two inches, the oil was applied—first sending a man over the road with a rake and broom to brush off all manure and other matter from the surface. The oil should be applied as hot as possible. At Chino we got it directly from the Puente oil refinery at a temperature of 250 to 300 degrees. We put it on at the rate of 150 barrels to the mile, eighteen feet wide. When we came to this part of the construction, the application of the oil, we met with difficulty. We did not have a machine that would properly put oil on a hard, smooth road. We had a De Camp machine, which was all right for dusty roads for working oil into the dust; but we had here an entirely different proposition. The outlets in the De Camp machine are six inches apart, and to cover the surface of a hard road with this required letting down enough oil to spread six inches, which is more than necessary, and even then there will be streaks and spots that are not covered. To get over this I had a man go after the machine with a street broom to spread the oil and sweep off the surplus into the gutter. This was a makeshift for our experimental work of last year. It served, but the process was crude and did not give the best results. There was a waste of oil, and the spots that were not covered when the hot oil descended from the machine were afterward covered by the broom with comparatively cold oil. This did not penetrate as deeply as did the hot oil. To remedy this I designed an entirely different machine to apply oil on such roads for this year's work. It is suspended from the rear end of the oil tank; is operated by levers and gauges; has outlets three inches apart covered by revolving gauges, by which any quantity of oil can be let out from the minutest stream up to 200 barrels to the mile for an eighteen-foot road. With the levers and gauges the operator can regulate the quantity discharged to a nicety, and the width of application from eighteen inches to six feet. The regulation of the quantity discharged is important, especially when you put oil on a road that has been oiled previously.

The result of our experiment at Chino has been a road that is hard and smooth and shows no appreciable wear after it has been down over a year. Many visitors mistake it for a bitumen road. A number of the storekeepers kept it swept before their places. This road has had three applications of oil since it was built, two last year and one this. The quantity put on this year was not more than about one-fourth that put on the first time. When oil is applied to such a road after the first application there is but little penetration and the surface is left sticky. To remedy this, some gravel (the same material of which the road is formed) is screened and sprinkled over the surface by a man expert in the use of a shovel. Just sufficient is put on to take up the surplus oil and no more. This is important. I designed a machine for this work, which will do it more evenly than a man with a shovel and at less expense. This sprinkling with gravel makes up for the previous wear on the road and in a few days packs down with the travel to a smooth, hard surface. If desired, it can be packed down at once with a roller.

The first application of oil to a road built as above described penetrates, if all the conditions are right, to a depth of about an inch. Uniting with this top layer of gravel it forms an elastic covering to the road beneath and takes the wear. And yet "elastic" is not quite the word. The surface has more of the yielding nature of

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lead and has a "flow" like lead. A heavy load on a narrow tire will dent it some, a wider tire following will smooth out the dent. It yields slightly to horses' feet and is therefore a favorite road with horsemen, giving less jar than a stone or cement road. Such a surface, which can easily be kept intact by slight repairs done at the proper time, serves as a buffer between the impact of horses', feet, the imprinting of wheels and the roadbed beneath and accounts for the slight wear.

PUBLIC WATER SUPPLIES.*

By George R. Perry, Mayor of Grand Rapids, Mich.

In the first place, an absolutely pure supply should be obtained, and as a second consideration that supply should be ample not only for the present, but the future needs of the city, and third, the system should be laid out on such a generous plan that the laying of pipes would always be a little in advance of the spread of population.

The question as to what is an ample supply is one that needs a considerable amount of thought, for what would be an ample supply in one locality might not be sufficient in another, and amount to absolute waste in a third place. The city I live in is largely a residence town and the soil is fairly sandy. The summers are generally hot and dry. To get at the needs of a family of, say five persons, I imagine they live in a detached house, have a lawn of 2,000 square feet, house supplied with hot and cold water, baths, water closet and laundry. I would place the actual needs of this family as follows: For bathing, 25 gallons; drinking, 5 gallons; cooking, 10 gallons; closet, 20 gallons; laundry and dish washing, 30 gallons, or a total daily use of 90 gallons for five persons.

If the lawn be wet 100 times during the year, which, in my opinion, is a liberal allowance, 375 gallons of water would be used for each time. This would bring up the total consumption of this family to about 70,000 gallons a year, or a per capita daily consumption of thirty-eight gallons apiece.

Of course, this is largely theory; now for some actual practice.

I live in a detached house, having quite an extensive lawn, and my family consists of four persons. We are not particularly careful in the matter of the use of water and the house contains all the usual conveniences. On March 31 I caused a meter to be put on the service, and on Sept. 1 I found that there had been used 2,500 cubic feet of water, or an average of a little over 400 feet a month. This would make our daily average use twenty-five gallons per person, in addition to providing for the sprinkling. I notice that for the months of March and April the meter registered 100 cubic feet, or about 700 gallons, the sprinkling of the lawn being responsible for the increase in use up to Sept. 1. Now, it follows if a family, situated as mine is, making a legitimate use of water, finds that twenty-five gallons a day is all they need, the use of 150 gallons a day certainly is waste. This is in face of the fact that in figuring the per capita consumption of water we divide the total amount pumped by the population in the city, notwithstanding the fact that a good share of the population do not use the water at all. This would increase the actual consumption of the water consumers very considerably. I believe that the question of water waste is going to be one of a great deal of importance and one to which we will have to give our serious attention.

Another illustration of the unrestricted use of water is taken from our city's books. I take this particular case because it is rented property and the landlord pays the water rate. The premises in question are situated on a corner, the lot is 50 by 132 feet and contains three residences, each of which has bath, sink and toilet accessories. They sprinkle the lawn and about two hundred feet of street. A meter was placed on these premises Nov. 28 of last year, and the reading Nov. 1 of the present year was 25,700 feet; this for 335 days would be an average of thirty-five gallons per day for each person supplied with water. It is my belief that a use to exceed thirty-five gallons per capita per day is simply wasted water.

Very few cities succeed in getting the proper use of water. I find that it varies in the different sections of the United States, as is shown by the following table:

	Population.	Gallons used.
Battle Creek, Mich	18,000	87
Madison, Wis	18,000	50
Bayonne, N. J	25,000	27
Boone, Ia	10,000	35
Danville, Va	15,000	42
Fall River, Mass	97,000	37
Harrisburg, Pa	60,000	85
Highland Park, Ill	4,000	50
Lowell, Mass	85,000	80
Montgomery, Ala	35,000	33
New Rochelle, N. Y	10,000	25
Newton, Mass	30,000	63
Pawtucket, R. I	35,000	72
Providence, R. I	160,000	57
Rochester, N. Y	190,000	63
St. Paul, Minn	160,000	60
Syracuse, N. Y	135,000	61
Tarrytown, N. Y	5,000	75

*From a paper before the Charleston convention of the League of American Municipalities.

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Washington C. H., O.	12,000	60
Yonkers, N. Y.	50,000	85
Aurora, Ill	30,000	40
Irvington, N. Y.	4,000	15
Kansas City, Mo	180,000	60
Alameda, Cal	15,000	40
Atlanta, Ga	100,000	60
Grand Rapids, Mich	90,000	152

It will be seen from the foregoing table that the consumption of my home city is largely in excess of that of the cities named, both larger and smaller. The question naturally occurs how much is waste and how much is use.

To show the extent to which waste occurs I would say that during the last season the superintendent of the water works made a test. The high service, as it is called, supplies a purely residence district, no factories or elevators being connected with it. Between the hours of 1:30 and 3 a. m., the pumps being stopped, the water in the standpipe supplying this service settled thirty feet, or at the rate of 2,000,000 gallons in twenty-four hours.

The waste of water is estimated by competent authorities to be 60 per cent. of the pumpage, in other words, but forty of each hundred gallons of water is actually put to some good use and paid for. Of course, it is possible to control this waste of water and there are two ways of doing it. The first is by rigid rules, absolutely enforced, and thorough frequent inspection; the other method, the more sensible plan, of asking each consumer to pay for the water he uses or wastes. The first remedy, frequent inspection, has always been unsatisfactory and to be of value must of necessity be expensive, while it is very annoying to the average housewife. She does not like the frequent visit of the inspector and soon he becomes a disagreeable nuisance in her sight and she plans to outwit him.

You would hardly expect any person who dealt in any other liquid aside from water to supply you with all you wanted, and allow you to help yourself at a fixed rate for the year, unless the party supplying you based that rate on the value of his entire output. Yet water and other liquids have a definite value and the value can be ascertained by the simple process of measuring.

In a municipal plant the first consideration is generally fire protection, and in this all the citizens have a common interest. It is necessary in order to meet this first requisite that the plant be kept in constant operation, so that it becomes possible to supply water to customers for other purposes. But as it is a municipal plant we have a right to expect that water will be supplied as near to cost as it is possible to do so.

There should be no sentiment in the business of selling water, it is a business matter and should be handled in a business way. The plant is operated in the joint interest of all the people, but as a general thing if the rates collected from the water users are sufficient to keep up the expenses of the plant the property-owner who does not use city water escapes payment for fire protection or for any other public use in which he may be interested. Justice demands that all should be used alike and there is no good reason why the large consumer should have a better rate than the small one, except on the principle that "to him that hath shall be given."

It costs a certain unmber of cents to pump a thousand gallons of water and each gallon costs its share of this expense, so it follows that each and every gallon should be sold at a price as close to this cost as it is possible to do. No one should be favored, and all should pay for what they get, the city as well as the individual. As the matter now stands in many public water plants the persons who use water pay a price for it that enables the city not only to maintain the plant and pay interest on the investment, but to furnish fire protection and make extensions of the service. This is a state of affairs that should not exist, and the sooner we correct the evil the better.

One of the questions that comes before us in selling water is the one of "free water." There certainly can be no such thing as free water unless, perhaps, it is when a man takes his bucket, goes to the source of supply and helps himself, and even then if his time is worth anything the bucket of water has an appreciable cost. I hold that there can be no such thing as free water when it is delivered through pipes, as in a city's water-works. Some one must pay for the cost of delivering each and every gallon, and if some one has free water it must follow that some user pays more than he ought or else the plant will be run at a loss. I cannot understand why those who use water and pay for it should be asked not only to pay for what they use themselves but in addition to furnish the water used in parks, schools and hospitals, or that they should be required to keep the watering troughs filled for the benefit of thirsty horses, fountains playing, sewers flushed or for fire protection and other municipal uses for which the city is expected to have free water.

A fire hydrant is located in front of a man's premises and as a consequence his insurance rate is made lower. At the same time, he may be buying his water of some private company and not contribute one cent toward paying for the direct benefit of fire protection. This certainly is not right and it is not just. The cost of water for fire protection should be spread upon all the taxable property of the city in exactly the same manner as the expenses of maintaining the fire department are

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spread. I believe in a uniform rate as being just and fair to all the water users, and each should pay upon one pro rata basis whether his consumption be 100 or 1,000 cubic feet a day. Of course, I will say in this connection that I believe there should be a minimum rate of, say, $5 a year as a charge for the privilege of having water.

I will say that from my experience I favor placing a meter on nearly every service. I believe it is the most economical system, not only for the individual, but for the city as well. Then it is the city assumes no risk and attempts no control over the plumbing beyond the property line. It is optional with the customer to make repairs or allow his pipes to leak. But you will soon find that the owner will be his own inspector and it will not be long until he repairs leaky and wasteful closets. He will find that it pays him to do so. The only objection that I have ever heard argued in connection with the universal use of meters has been the one that poor or penurious people would use too little water for sanitary purposes. That this objection is largely one of imagination will occur to any one who stops to consider that the average rate for water in twenty-seven of the principal cities of the United States is a trifle less than four barrels for 1 cent. In some places double this quantity is supplied for the same price. This being the case, it is hardly possible that any one would suffer for a supply, everybody paying a fixed rate per year, payable quarterly, whether he used much or little water. This would pay for the use of the meter and would of itself secure the use of sufficient water for flushing drains and to prevent unsanitary conditions.

In this connection the record of the water-works at Flint, Mich., becomes worthy of consideration. The plant is operated under private ownership. In 1893 it had 700 services and was pumping an average of 1,409,000 gallons a day, or 200,014 gallons per tap. The fuel bill at that time was $4.69 per tap. Four years later the plant had 992 services, 886 being metered. The daily pumping was 689,000 gallons, the fuel bill had dropped to $2.25 per tap and the water pumped had fallen off nearly one-half. The repair account was reduced in like proportions.

This is only one instance and I do not doubt but what the instances could be multiplied. I am satisfied that where we have public ownership of a water plant we allow our customers to become reckless and careless in the use of water. Nearly all cities have more or less trouble trying to enforce sprinkling rules and you will always find the citizen who insists on sprinkling his lawn or street at some time contrary to the rule. Where meters are used there is no occasion for any other rule. The consumer pays for all the water he uses and it is safe to leave it to his discretion as to how much he will take. I notice the gas company places no limit on the number of hours customers shall keep the lights burning.

CHICAGO'S LIGHTING PLANT: ITS PROGRESS UNDER MUNICIPAL OWNERSHIP.*

By Edward R. Ellicott, City Electrician.

In Chicago the civil service commission examines and certifies for employment all employes required in the operation of the lighting system. Each employe is certified to the class of work he was examined for and a probational employment of six months is given. If his services are satisfactory during this six months he becomes a regular employe and can be discharged only on written charges made to the commission, before whom a hearing of the charges may be demanded. Discharges are practically limited to neglect of duty, dishonesty and intemperance. For violating rules of the department a suspension from duty for a period not exceeding thirty days may be given. This system insures men of reasonably good ability for the work they are to perform and employment to them during the period of their good behavior and attention to their duties.

The first lamps were installed by the city in 1857, when a small plant of 105 lights was erected. It was subsequently increased by the addition of 192 lights in 1888, 372 lights in 1889, 260 lights in 1890, 64 lights in 1891, 109 lights in 1892, 117 lights in 1893-95, 138 lights in 1896 and 184 lights in 1897. The lowest cash cost of operation per lamp up to this time was $96.40 a year.

In 1898, at the request of Mayor Harrison, the council appropriated $100,000 for the purpose of extending the lighting system. During the year 860 additional lamps were placed in operation and the yearly cash cost of operation was reduced to $65.52 a lamp.

In 1899 the council appropriated $150,000 for extensions and 1,204 lamps were added to the system. The operating cash cost was reduced to $55.93 a year. For the increase during 1900 an appropriation of $200,000 was

*From a paper read before the League of American Municipalities, Charleston, S. C., Dec. 15, 1900.

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made, but only $160,000 has been available. Seven hundred additional lamps have been placed in service and conduits installed for 300 more, part of which will soon be in operation. A total of 4,200 arc lights are now in service lighting about 325 miles of streets. At the present rate of progress the city will be practically lighted from its own plants at the expiration of six years; nearly three times as many lights have been placed in service during the last three years as in the previous ten years.

The debatable question has always been—does it pay to operate a municipal street lighting plant? The cash cost of operation, as given, does not represent the total cost in every instance, but the figures given approximate it very closely, as nearly 5 per cent. of the yearly cash cost, as stated, is really due to and expended on account of depreciation. No charge has been made for interest on the investment, as no bonds have ever been issued or liabilities assumed by the city in building the plants. The system as it stands today has been paid for out of the general taxation funds and does not owe an interest charge any more than each street that has been improved, or some other public work that has been similarly paid for and used for the benefit of the general public. The depreciation of an electric light plant depends upon the class of construction, character of machinery installed and the manner in which it is operated and maintained. Arbitrary depreciation charges therefore cannot be made, for what might apply to one plant would not apply to another differently constructed and operated. The municipal plants in Chicago are well constructed and maintained, constant improvement is being made and charged to yearly operating expenses.

That argument may be eliminated as to what charge should be added for depreciation, and facts presented to show conclusively that it has paid the city of Chicago to own and operate its present lighting system. The total amount of money paid out for constructing the plants and maintaining them since 1887, as compared with what the city would have paid for an equal number of lights rented from private companies at prevailing prices during the same period, shows that the cost of construction was: Construction of 3,500 lights and operating expenses to date, $2,548,430. Rented lights would have cost $2,111,043.

The city has in its plants today as good and modern machinery as will be found in the majority of plants in this country. It has over one hundred miles of valuable conduits, over two hundred miles of lines overhead, a full complement of lamps, lamp posts and appliances to make up a complete system; all of which are in such operating condition that the city is producing an arc light at a yearly cost not exceeding sixty dollars.

It has acquired this system of lighting, had the benefits of the lights and, as it stands today, it has cost the city, as compared with rented service for the same period, $437,387. This amount represents the entire cost of the plants to the city.

There are employed in the operation of the system a total of 101 men, who work eight hours every day in the month. The salaries paid average $70 a month for each employe, including common labor, and this average is higher than that paid by any private corporation of which any record can be obtained. That good service, irrespective of politics, meets with steady employment it is only necessary to give the length of service of the men employed. Out of a total of 101 men five have been employed thirteen years, nine men eleven years, five men ten years, five men seven years, ten men six years, five men five years, fourteen men four years, thirteen men three years. The average employment for these sixty-six men is six and a half years.

It is doubtful if many private corporations can show as good a record of employment, and it illustrates that there is a decided distinction between holding a political job and retaining a positon in the public service. Each employe has a certain amount of work assigned to him and it is equal to that of every other doing work of the same class; consequently there is no dissatisfaction among the men on account of favoritism.

Under these conditions the city of Chicago has constructed and is operating the largest municipal street lighting plant in the world, and furnishing lights within reasonable limits of economy. The service is as good as could be obtained from private corporations, who, as a rule, employ the cheapest labor, use the poorest materials and sacrifice the service for the purpose of making a larger profit.

There is no public service of greater importance than lighting the streets, and on account of the difficulties of covering a large territory it can only be undertaken by those who may have the facilities. It is absolutely necessary that a city like Chicago shall be entirely independent of private corporations in the furnishing of public service of this character and the condition can only be brought about by municipal operation of its entire lighting system. Every effort possible is being directed to secure this condition and each year will see a substantial increase in its municipal plants.

Police records prove that crime and darkness are closely related. During the last three years there is no record of a robbery having been committed in Chicago on a

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street properly lighted by electric lights, and the only reason assignable is the fear of detection and recognition. Such an important factor in the protection of the public should be under municipal control and receive the same attention and consideration as a police department.

With 4,200 lights in service the city is saving by municipal operation the sum of $160,400 annually, but, ignoring the economic consideration, it should be remembered that the municipal ownership of a street lighting system is not even a question of principle—it is a duty a city owes to the public.

REMUNERATION TO CITIES FOR FRANCHISE RIGHTS.*

By Bird S. Coler, City Comptroller, New York.

The topic which I find myself called on to discuss is: What remuneration, if any, should be exacted from light, water, street railway, telephone and subway corporations and how should it be collected?

This title naturally excludes from discussion all questions relating to municipal operation of franchises; it presupposes that such franchises are to be privately operated and contemplates consideration only of the terms upon which the grants should be made.

What is rather loosely termed "municipal ownership" is now, so far as it relates to franchises involving the use of city streets, scarcely to be regarded as debatable ground. On the subject of municipal operation, however, there is much to be said for and against, and I am glad, therefore, to have to deal, within the limits of this short paper, with the simpler problem.

I take it for granted that no one will now dispute the proposition that the public should receive remuneration, in one way or another, for the use of its streets by private corporations. The only question is: How can that remuneration be most justly exacted and most successfully collected?

The city of New York has for over two hundred years been dealing with this problem with greater or less success—generally with less. It began leasing its ferry franchises in 1674 and twelve years later its right to control such privileges was confirmed by the famous Dongan charter.

The granting of franchises for street surface railroads in New York belongs to the history of the last fifty years. During the first half of this period these grants were made directly by the state legislature, generally without any provision for compensation and always without adequate provision. Unfortunately the most valuable of these franchises were thus disposed of during this time.

The constitutional amendment of 1874 called for the action of the local municipal authorities, and in 1884 a general law of the state provided for the sale of all such franchises at public auction to the highest bidder, and prescribed a minimum, or upset price, of 3 per cent. of the gross receipts during the first five years of operation and 5 per cent. thereafter.

Compensation for sub-surface rights, such as those enjoyed by telephone, telegraph, gas, electric light and power, steam heating, refrigerating and other subway corporations, has received scarcely any intelligent consideration. In fact the great value of some of the franchises in a great metropolis like New York has only during the last few years attracted any popular attention whatever.

In my judgment the most important point to emphasize in regard to this subject is that, no matter what the method of exacting compensation may be, it is practically impossible for municipal authorities to make any bargain with a private company which will not appear inadequate to the next succeeding generation. When the most valuable surface railway franchises in New York were being disposed of, there might have existed some extraordinarily far-sighted man who could have foreseen the immense growth of the city and prophesied what their value would be in the future. But if such a man had been in a position of sufficient authority to demand what he deemed to be an adequate compensation, the promoters of the railway enterprises would have stood aghast at his figures. The railroads would simply never have been built. And if the railroads had not been built the growth of the city would have been stunted and the prophet would have stood discredited. Here lies the problem then. On the other hand not to discourage enterprising capital and on the other hand to place some limit on its profits. Now, if the city makes a poor bargain, but that bargain has only, say, twenty-five years to run, there is no great harm done; for twenty-five years is as nothing in the life of a great city. But if a franchise be granted in perpetuity of for a very long period—like that of the New York and Harlem company, which runs until the year 2,389—no matter how advantageous the bargain may seem to day it is likely to appear quite ridiculous an hundred years from now. Short terms for franchises are, therefore, the most important thing. If that principle be strictly adhered to more than half the fight is won.

*A paper before the League of American Municipalities.

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As to the methods of exacting compensation, I fear that we suffer somewhat from too much devotion to theories, logic and philosophy. There is no one method which will best fit all cases. There are advocates of the principle of exciting competition by offering franchises for sale at public auction. Others believe in a legislative fixation of arbitrary amounts either by way of cash payments or percentages on gross or net receipts. Still others believe in granting to local authorities a certain freedom of barter in arranging terms with those seeking to obtain franchises. On the whole, I favor the last-mentioned course, though there are conditions under which it is not desirable.

I think it likely that in the case of a comparatively small, but growing, city, where practically no transportation facilities exist, the method of franchise sale at public auction, with a fixed minimum or upset price, might work well. But where, in large cities, like New York, the chief thoroughfares are already pre-empted; where the existing surface lines are controlled by a monopoly; where the question of transfer facilities practically rules out all newcomers, there can be no such thing as genuine competition. In such cases the local authorities can do much better if given a free hand to bargain in behalf of the city than if compelled to sell at auction. In saying this, however, I am presupposing that the bargaining power shall be vested in either one official or a board of a very few officials of rather more than the average intelligence and integrity, and upon whom the responsibility for any abuse of power can be fixed with certainty. This can never be done in the case of local legislative assemblies. In most of our cities the local legislatures do not bear the most enviable reputations, and even the best of them are so hampered by legislative conditions as to be inefficient administrators.

Under the provisions of the Greater New York charter the local legislature, it is true, possesses exclusive power to grant such franchises, but it is provided that any ordinance granting such a franchise "shall on its introduction and first reading be referred by the municipal assembly to the board of estimate and apportionment, who shall make inquiry as to the money value of the franchise or privilege proposed to be granted, and the adequacy of the compensation proposed to be paid therefor, and no grant thereof by the municipal assembly shall be made except on terms approved by vote or resolution of the board of estimate and apportionment."

The practical effect of this provision is to leave to the popular legislative body the power to decide the broad question of whether the public interests demand the granting of a franchise, and also to veto the terms proposed by the board of estimate and apportionment, but the latter board is vested with those powers which may be said to relate to the business or commercial aspect of the proposition.

As the board of estimate and apportionment in the city of New York has always been a more or less efficient body, which has through all the changes of administration generally retained the confidence of the public, this scheme is one which has generally commended itself to students of New York City municipal affairs.

Since the Greater New York consolidation, only two grants of franchises have been made under this provision, but the terms of the grants have been decidedly better than those which had previously been obtained by operation of the general railroad law requiring sales of such franchises at public auction.

On Dec. 5, 1899, the board of estimate and apportionment fixed the money value of the franchises sought by the Kingsbridge railway company and the Ft. George & Eleventh-ave. railroad company as follows:

Four per cent. of the gross receipts during the first five years of operation.

Six per cent. during the second five years.

Eight per cent. during the third five years, and

Ten per cent. during the remaining ten years.

These two franchises affected routes in comparatively undeveloped portions of the city, so that the operation of these railroads will not probably be profitable in the beginning. Nevertheless before the expiration of the twenty-five-year term of the grant it is practically certain that the city will be thickly settled in these localities, and at the end of the term the city will be free to fix new rates of compensation.

It seems to me that such a plan as this comes as nearly as possible to the ideal method of exacting compensation for street railway franchises otherwise than municipal ownership and operation.

There are many important cities of the country which do not possess boards similar in composition to the board of estimate and apportionment, but I know of no reason why in such cases the functions performed in the city of New York by the board of estimate and apportionment should not be performed by either the mayor or comptroller of such cities, acting either alone or together. The principal thing is to have the business transaction connected with the granting of such franchises conducted on behalf of the city by the highest type of official possible, and to center the responsibilities so that there can be no escape in case the terms of the grant be manifestly improper. I think it is under such conditions that the best solution of this problem is to be found.

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CURRENT INFORMATION.

Wooden Blocks Next to Rails in Asphalt Pavement.

Consul Hughes at Coburg has reported to the state department that German engineers, after many experiments, believe that they have devised a plan by which the injurious effects of the passage of heavy electric street cars upon asphalt pavements are obviated. He says:

Contrary to ordinary practice in which the tram rails are laid immediately upon a foundation of concrete and in direct contact with the superimposed asphalt, the new method consists in laying the rails upon a bed of coarse gravel and running a line of hardwood blocks along either side. Experience has shown that ordinary pavements, with gravel and stone foundations in place of concrete, offer the greatest resistance to the influence of electric cars. It is assumed that the gravel or stone allows the rails more play. The new method is also relied upon to reduce the noise caused by the cars running over the lines.

Asphalt Pavements Damaged by Gas.

The committee appointed by the common council of Utica, N. Y., to investigate the effect of illuminating gas from leaky mains on asphalt pavements, submitted a report Dec. 7. The committee says that there can be no question but that the gas from leaky mains will disintegrate and injure an asphalt pavement. The effect of gas, which is a hydrocarbon, is the same as that of coal tar, another hydrocarbon, both of which soften asphalt, reducing it to a tar-like substance, in which condition it does not have cementitious properties necessary for holding together the particles of sand in the mixture. The committee cites that several cities, including New York City, have investigated this matter, and reached the same conclusion —that leaky gas is injurious to pavements. In conclusion the committee recommends the adoption of steps requiring the gas company to renew all defective mains and lot laterals, and at their expense to repair the damage already done to the pavements.

Contest Over Venezuelan Asphalt Concession.

Press reports give some statement of a controversy over the ownership of certain concessions for asphalt deposits in Venezuela. The National Asphalt Company has concessions which cover large deposits. Recently what is known as "La Felicidad" concession has been granted to Charles F. Warner, P. R. Quinlan and P. Sullivan. About one-third of this concession is said to overlap the concession of the National Asphalt Company. The first decision of the high federal court of Venezuela was in favor of the National Asphalt Company. The other company, upon pressing the matter, claims to have secured an agreement that the matter should be arbitrated by the minister of the interior, and that official has recently decided in favor of Warner and his associates. The National Asphalt Company denies that it made such an agreement, and claims that it proposed to submit to a resurvey of the lands in dispute by a commission of three, one appointed by each of the interested companies and one by the president of the republic. It is claimed that this commission decided in favor of the National Asphalt Company. The latter company is prepared to maintain its rights. Some stir has been caused by what seems to be an attempt to make a political matter of the controversy involving a possible contest with the Venezuelan authorities and an appeal to the United States government for protection. The remote location of the lands in question and the difficulty of reaching them give time for many rumors, which have little foundation.

Meeting of N. B. M. A. Brick Pavement Committee.

The committee of the National Brick Manufacturers' Association to prepare specifications for the most approved methods of constructing brick pavements, met at Indianapolis Dec. 21, and during a long session extending well into the night, prepared a report to be submitted to the next convention. D. V. Purington, Chicago, Ill., is the chairman of the committee. W. P. Blair of Terre Haute, Ind., and T. B. Townsend of Zanesville, O., are the other members.

At the suggestion of N. B. M. A. the American Society of Municipal Improvements passed a resolution instructing its president to appoint a committee to co-operate with this committee. If such joint consideration of the matter can be secured, the result should be a valuable guide to cities in preparing specifications, since the committees' report can be used as a basis, such modifications being made as local circumstances seem to require. A report embodying the ideas of the brickmakers and the designers and supervisors of pavements should be more complete and more satisfactory than one prepared by either society alone.

Certain Guaranty Bonds on Pavements in Louisiana Not Valid.

The Louisiana supreme court has rendered a decision in the case of S. D. Moody & Co., Ltd., against Chadwick, in which a personal judgment was sought with recognition of a lien upon the property in front of which a brick sidewalk or sidewalks had been constructed. The court holds that in New Orleans, where the case originated, no personal liability attaches to the owner of the property for paving of the sidewalks in front of the same by the city authorities; the property itself is liable only for its proportion of the total cost of the work, and not for the cost, according to the frontage,

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of the paving along the front of the square on which it is situated. The court says that it is a self-evident proposition that the use of a paved or macadamized street by the traveling public for one year will injure it to some extent at least. The material of which the pavement is made may wear in some places, or break or become injured in others; and under his guaranty bond, either the contractor is required to make the necessary and proper repairs himself, or the city can make them and require of him and his bondsmen the cost of such repairs. The amount of such injury by ordinary use is a matter of conjecture. It might be $1,000 or more, but whether more or less, the principle is the same. It could make no difference, in case the injury were $1,000, whether the contractor would spend the $1,000 in making good the injury by repairing the street himself, or pay it to the city and let the city spend it for the same purpose. Neither does the time make any difference. If a contract to keep in repair for five years is a burden upon the taxpayers, so is a contract to keep in repair one year. Such a contract is a burden in either case, although differing in degree. No contractor would undertake for nothing, after having fully complied with his contract, to guarantee the work "from injury by ordinary use" for one year, because no matter how carefully and conscientiously he might comply with his contract in every detail, so as to be entitled to all agreed to be paid him, he must, in addition to so performing his contract, pay the wear and tear of the street by ordinary use for one year.

It was agreed that the bond was required as a guaranty that the work would be well done, and that the bidder was responsible. In passing upon the validity of requiring the bond, the court, however, gives this contention no weight, nor does it find any different rule from the one it announces adopted in any other state, except where the statute is different.

How Public Spirited Women Are Improving a Town.

Through the united efforts of the women of Uniontown, Pa., that place has the best sidewalks of any village in the state. Nearly the entire town has good flagstone sidewalks, secured without taxation of anybody. This result was brought about as follows: One property owner had a stone sidewalk laid in front of her property, which proved so satisfactory that she discussed the question of having stone sidewalks for the entire town. Other women became interested in her project, but the men were dubious and objected because of the taxation to be incurred. The women held a meeting and formed an improvement society. They decided that nothing but stone walks should be laid. A series of socials, bazars, quilting bees, oyster suppers, ice cream socials and other tactics were resorted to in order to raise the money for the walks. Stone was purchased by the carload and an appeal to the men to get the stone from the cars to the desired places proved successful. The women's improvement association now contemplates the establishment of an electric light service. Uniontown has 600 inhabitants.

Pavement Guaranty Bonds Not Valid in California.

The California supreme court holds that a specification in a city ordinance providing that all persons bidding for street work shall "file a bond in the sum to be determined by the mayor, guaranteeing the work for one year from injury by ordinary use," increases the burdens of the property owners, is unauthorized by the statutes of the state, and renders a contract for street paving and the assessment void. It does not consider either, that any distinction can be made to the effect that the provision only guarantees the work, and does not require the contractor to keep the streets in repair, as in the case of some other contracts that have been condemned.

Sub-Grade Railway Crossings Adopted by Village of Averyville, Ill.

Viaducts have been decided upon by the village trustees of Averyville, Ill., to insure safety at the crossings of the Rock Island and Peoria railroad. The plans, which were prepared by Jacob A. Harman, C. E. of Peoria, provide for steel bridges eighteen feet wide and nine feet above the road, over which the railroad is to pass. About 6,000 yards of excavation will be required, and it is proposed to share the expense, the city to do all the excavation outside the railroad right-of-way. The village may decide to widen the subway to twenty feet and raise the height of the bridges to ten or twelve feet.

Philadelphia Board of Public Safety Controls Lighting Contracts.

Judge Wiltbank of Common Pleas Court No. 2, Philadelphia, Pa., handed down an opinion Nov. 25 in the equity suit to determine whether the advertisement for proposals and the awarding of contracts for the lighting of the city streets during 1901 is within the powers of the department of public safety or the department of public works. Proceedings were instituted by William McIntyre, William C. Bird and George E. Potts, directed against Abraham L. English, director of department of public safety, to restrain him from receiving any further bids or awarding any contracts on those already received in response to advertisements which were opened Nov. 26.

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It was claimed that under the provisions of the Bullitt bill and the various ordinances passed by councils from year to year regulating the lighting of the city streets, the department of public safety has nothing whatever to do with the awarding of the contracts for lighting the city, that work being done under the control and supervision of the department of public works.

Judge Wiltbank dismissed the motion for an injunction, saying:

What may be described as the electrical service of the city of Philadelphia, involving the management and use of conduits, wires, poles, arc lamps, for the storing and consumption of electricity, has been in charge of a bureau of the department of public safety from a time before the introduction of arc lights as a means of illumination and continuously since. It is true that the department of public works has also in some degree a control of electric appliances, as, for instance, in the city hall, but the proofs make it clear that so far as the public illumination of the highways of the city is to be considered, the department of public safety has, through the bureau referred to, always acted exclusively of the department of public works, and since 1893 continuously to this time the annual ordinances of the councils of appropriation of funds to the maintenance of the lighting of the city by electricity have been directed to the department of public safety.

This same point was decided about a year ago in Common Pleas Court No. 3, in a suit brought by George E. Potts against a number of city officials and the companies forming the "electrical trust." The decision then was adverse to Mr. Potts. He appealed to the supreme court, where the lower tribunal was upheld.

Fargo, N. D., Lighting Contract Upheld.

In a decision rendered by Judge Pollock recently in the case of Lee Roberts vs. Fargo (N. D.) Gas & Electric company, he sustains the contention of the company. The suit was brought to set aside the company's contract with the city for street lighting. The contract was to cover a period of ten years. The plaintiff claimed that the covenant was void in that it pledged a certain portion of the city's revenues for the term named. Judge Pollock holds that the contract was made in good faith and that both parties are bound by its terms until either fails to live up to its agreement. The decision is important so far as contracts are concerned in that state. The case will be appealed to the supreme court.

Acetylene Gas in Germany.

According to the report of Dr. F. Rose, British consul at Stuttgart, acetylene gas is growing in favor in Germany. He reports that in Europe over 120.000 H. P. is devoted to the manufacture of calcium carbide, and at the present time Germany has 200,000 acetylene gas jets installed. German capital is being invested in its manufacture in Norway and Switzerland and other foreign countries.

Failures to Recover Damages from Water Company for Lack of Fire Pressure.

The Mississippi supreme court rendered a decision Dec. 4 in the suit of D. W. Wilkerson vs. The Water Works Company. The appellant had sued in the lower court for $10,800 damages, alleged to have been suffered by him because of the failure of the water works company to keep the necessary pressure, whereby his house and furniture were burned, the firemen finding it impossible to reach the flames with the pressure available. The plaintiff's attorneys contended that the contract entered into between the city and the company was also entered into for his special benefit as a citizen, the consideration being the taxes paid and the concessions granted, and that there was sufficient privity of contract between the citizen and the company to entitle the former to recover damages suffered by a breach of the latter's contract with the city. Judge Boothe, in his decision, held that there was nothing in the contract between the two nominated parties to indicate that it was made for the appellant's benefit, or for any other person's benefit save the city, in its corporate capacity as a branch of government, and that, therefore, there was no privity, and the appellant could not recover. The decision is interesting, in that other suits amounting to about $20,000 had been entered against the company because of the same fire.

In this connection the following letter will be of interest:

To the Editor of Municipal Engineering:

Sir—In your December number you have a short news note on page 418 with a caption, "Water Company Must Pay Damages for Lack of Pressure at Fire."

I join you in the hope that the case may be appealed so that it can be passed upon from a strictly legal standpoint independently of a verdict by a jury. It would seem as though there had been enough experience in general business, involving the rights of parties under contracts, to insure in each case the actual existence of a proper instrument stating and bounding the rights and responsibilities of the parties thereto. But, nevertheless, disputes of the nature you set forth are constantly arising, sometimes tinctured and sometimes not. with the sentiment classified under the head of "Municipal Ownership."

A city, of course, and quite naturally, too, desires to have, and enjoy, and assert, its rights under any contract and at any time. A water or light company is quite as earnest in looking after its interests, property and investments; but both, apparently,

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seem to start out at times without proper knowledge and definition of rights, privileges and responsibilities. I have just had to do with a case wherein the very same grounds for a suit were taken as are indicated in your caption, viz.: damages for lack of water pressure, and the suit in a United States court before a judge was decided in favor of the water company, although it was shown and not denied that there was a lack of pressure at the hydrants near the fire. The loss involved was about $50,000.00 and the principal points were a sprinkler system advocated and approved by an association of insurance companies, the system attached directly to the street mains, but having inadequate auxiliaries; the destruction of the sprinklers by the burning building, and the "bleeding" of the street mains to an extent which prevented effective fire streams from the hydrants.

I am prompted to send you this for the reason that your caption might be taken for an axiom in its line; and, of course, the usefulness of your journal depends somewhat upon the brightness of the light it sheds on the extremely interesting matters and questions pertaining to municipal improvements; and as I am trying to find light for my own limited uses, I shall be glad if a feeble ray can be made to help illuminate the vexed controversy between cities and companies.

The question of valuation of water and lighting plants, quite often coming up for decision, is complicated more or less by the difference which exists between the value of a plant as an investment or going business; and the actual cost involved in building it. If the net income of a water company's plant capitalizes for more than the works can be duplicated for, then the water company is in a scrape in case of disagreeable relations. But if the cost of duplication is more than the capitalized investment value then the city has the short end of the lever. It often requires careful investigation to bring forth a clear statement of both sides, but of course the general practical advantage is with the city, although courts as a rule recognize and carefully consider the full legal rights and claims for equity set forth by companies doing business under public franchises and contracts. The settlement of such cases is almost invariably too strictly legal for a jury to handle as they are apt to rest more upon the law than upon the facts.

CHARLES A. HAGUE.

39 Cortlandt-st., New York.

Yellow Fever Propagated by Mosquitoes.

It is now stated that the investigations of a board of physicians in Cuba indicate a probability that yellow fever is propagated by mosquitoes rather than by infection through contact with polluted clothing and the like. It is even declared that the mosquito cannot transmit the disease until fifteen days after it has bitten a person suffering from the disease.

If this proves true, as well as the earlier statements that malarial diseases are also transmitted, the most effective primary protection will not be drainage and disinfection, except so far as these prevent the propagation of mosquitoes. Mosquito-proof dresses and houses would be desiderata in any event. There has not yet been a complete demonstration of either statement.

A City Without Municipal Government.

Bonne Terre, a town in Missouri of 5,000 inhabitants, is probably the largest place in the United States without any municipal government. As matters now stand, Bonne Terre is merely a part of the township of Perry in St. Francois county, and the officials of that town look after the welfare of the residents of Bonne Terre and see that order is maintained. The town has scores of pretty dwellings, and in stores, schools and other buildings it is said to resemble a dozen western cities which for years have had mayors, common councils and city tax rates. Up to thirty years ago the town was only a mining camp. After the civil war mining companies sent in prospectors and found lead in such quantities that large sums were invested in the vicinity of the village. Miners then went to the settlement and took their families with them. The companies erected buildings for the miners to live in and stores for the merchants who went there. The people have often discussed incorporation, but the lead company, which owns nearly all of the place, is opposed to incorporation, and no one else cares enough about it even to start a movement to make a village.

Ogden, Utah, to Recover Damages for Alienation of Water Plant.

A report has been made to the court by the master of chancery, S. H. Lewis, in the action of Ogden City, Utah, vs. Bear Lake and River Water Works and Irrigation Company, and the Beaver River Irrigation and Ogden Water Works Company. The master in chancery says that the city is entitled to damages as follows: Rental of old system, ten years, $120,000; return of money paid for water, $41,668.91; damages for destroying old system, $15,000; total, $311,668.91.

These findings will be reported to Judge Hiles, who tried the case and ordered the accounting. If he approves the master's findings he will order judgement entered against the defendants in favor of Ogden City. Under the decision of Judge Hiles, the

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city will have a first lien on the present system of water works in Ogden upon which to satisfy this judgment, notwithstanding the present water system has passed to the Ogden Water Company now operating it. It is probable that the defendants will appeal to the supreme court, but if the decision in that court sustains the lower court, Ogden will secure the present system or sufficient money to build a new system.

Judge Hiles's decision was rendered May 18, 1898, and was given in the June issue of Municipal Engineering of that year, the points in the case being as follows: The city of Ogden constructed a water works system at a cost of about $110,000. The system was operated for several years by the municipality, but its service to the public was unsatisfactory, and in August, 1889, John R. Bothwell entered into a contract with the city agreeeing to put in a system of much greater capacity and efficiency at an expense of $300,000, in consideration of which the city leased to him the existing plant for the sum of $1 during the time he continued to furnish water from his system. Bothwell transferred his lease to the Bear Lake & River Water Works Company. In 1891 this company took out the water gates, valves, crosses and T's, together with many sections of pipe of the old city plant, thus rendering it useless. Judge Hiles held that this action of the city in turning over the municipal plant was a collusive alienation of trust. The transaction is a breach of trust, ultra vires, and void. An accounting to the city of Ogden on all matters properly cognizable relating to the property and franchises of the old system since Oct. 27, 1890, was ordered by the court. The above report was in accordance with this order.

Arbitration Fixing Contract Price for Water for Tama, O., Declared Void.

A jury verdict was returned Dec. 12 at Toledo, O., in the suit of the United States Filler company against the city of Tama. The company sued to recover $2,400 per year for five years' pumping of water to the city. In 1892 the city of Tama entered into a contract with the Tama Paper company by which the latter was to furnish water to the city for a period of ten years. The contract price was $900 per year, but a specification in the contract provided that at the expiration of five years, should either party have a difference of opinion as to the proper price for the pumping, arbiters should be selected to determine the matter. The paper company's plant changed hands in the meantime, passing into control of the United States Filler company, manufacturers of egg case fillers. The price being paid by the city was not considered sufficient. In accordance with the contract the city and company each chose an arbiter, and a meeting was held Dec. 21, 1897, when it was agreed that $900 was a fair price for the city to pay for the pumping. Later in the evening Manager Batcheider of the filler company came before the arbiters to state the company's claims, but as the decision had been reached no further consideration was given. In the present suit the plaintiff claimed there was no arbitration, and the jury in its verdict awarded the company compensation in the sum of $1,184.17 per year additional to the $900 per year that the city has offered to pay the company.

Captain Carter Remanded.

The federal court in the district to which O. M. Carter, Captain U. S. A., applied, handed down a decision Dec. 10, denying the petition for his release on a writ of habeas corpus and remanding him to the federal penitentiary at Leavenworth, Kas. This is the sixth time that Carter's case has been before the United States courts since his sentence for complicity in the Savannah harbor frauds has been approved by the president. In every case he has endeavored to escape through some legal technicality the sentence imposed upon him by the court martial.

Water Bonds Valid Though Vote Was Restricted to Tax Payers.

A decision was handed down Dec. 3 by Justice W. E. Scripture, in the case of Ceilam N. and Adelbert Spitzer against the village of Fulton, N. Y. This was an action to impeach the validity of water bonds issued by the village when they were acquiring the water system a few months ago. The plaintiffs claimed that the bond issue was unconstitutional because the privilege of voting at the village meeting at which the bond issue was authorized was confined to property-owners or those whose wives were property-owners.

Justice Scripture supports the validity of the bonds as well as the constitutional point involved. The case will probably be taken to the appellate division of the court.

Urbana, O., Water Works Election Void.

A decision was handed down by Judge Heiserman, Dec. 10, in the suit of the Urbana Water Works Company, Urbana, O., against the board of election, et al., to enjoin the payment of the expense of the water works election. The court holds that the county board of election was in error in calling the special election without the authority of the council: that the mayor had no authority to call the election unless the council should pass a resolution to that effect: that the time for holding the election for county officers was fixed by the legislature, and the election board did not

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depend upon the sheriff's proclamation for calling an election, and in this case they should not have acted upon the proclamation of the mayor; that the law provides that no contract for furnishing water supply to the city shall be in effect until first ratified by the people, but unless the council should set a special date for the election the question should come up for a vote of the people at the next regular election; that the only body having authority to fix a time for the election was the city council, and the only authority the board would have for calling such an election would be a certified copy of the ordinance.

Judge Heiserman said that he regretted that the judges and clerks should be compelled to perform their duties all day long without any compensation, and he thought the suit should have been filed before the election was held, instead of allowing the judges and clerks to devote their services to a work for which they would receive no compensation. He said that if the matter of holding elections were left to the sweet will of the board of elections, elections might be held in every month of the year. The temporary injunction was made permanent.

The Discoverer of Septic Tank Action Followed by Filtration, in Sewage Purification.

To the Editor of Municipal Engineering:

Sir—In the last issue of Municipal Engineering (page 420) appears a letter in regard to the "Discoverer of Septic Tank Action Followed by Filtration."

Being interested in the subject and somewhat amazed at the boldness of the claim made for Mr. Glover, I sent for a copy of patent No. 559,522, of May 5, 1896, but am unable to discover anything it in to indicate that Mr. Glover was the originator of what is now known as the septic tank or that he claimed to be. He refers incidentally to a "settling tank" from which he proposes to take the sewage, but he does not embody it in his claim or show it in his drawings, nor does he indicate any knowledge of bacterial action taking place in it.

The method set forth by Mr. Glover consists first of filtering sewage from the "settling tank" through "primary beds constructed to arrest the solid matter and permit the escape of the liquid matter," the filtering material mentioned being sand, gravel, etc., on the walls of porous pipes of unglazed earthenware. These "primary beds" are shown inclosed in a building and from them the effluent passes to secondary filters out of doors.

There is nothing new about the septic tank except some of the details of its construction.

Every town of any size which has not yet secured a sewer system is full of these tanks under the old name of cess pools; and many of the cess pools are constructed in such a way as to anticipate the most important features of the modern septic tanks as set forth by recent writers.

What is new is the knowledge we now have of the processes which take place in them and their adaptability for the preliminary treatment of sewage.

JOS. O. OSGOOD, M. Am. Soc. C. E.
71 Broadway, New York.

The above letter was referred to Mr. McClintock, who makes the following reply:

To the Editor of Municipal Engineering:

Sir—Your favor of the 18th, inclosing letter of Jos. O. Osgood of New York dated Dec. 11 came to hand this morning and I am pleased, through you, to give Mr. Osgood the desired information by referring him to public documents bearing on the subject. Let him send for patent 258,744, issued May 30,1882, to Mr. Amasa S. Glover of Brockton. The 1887 or 1888 report of the Massachusetts State Board of Health contains a description of what Mr. Glover claimed under his patent, and may be found under the head of the article indexed "Brockton, sewage disposal of." Mr. Osgood already has patent 559,522. To understand this patent he should consult the Massachusetts State Board of Health report for 1895 and read the article indexed "Andover" and the 1895 report of the same board under the head "Danvers Lunatic Asylum." The firm of Messrs. Wright, Brown & Quimby secured both patents for Mr. Glover. The first was intended to cover septic action; the second was intended to cover single and double filtration after septic action.

It is for our interest as well as for the interest of the public to bring this matter before the United States court for adjudication. We have secured the services of the Hon. Charles H. Drew, Col. Francis S. Hesseltine, Charles H. Sprague, esq., and Morris L. Messer, esq., all of Boston, as our counsel, to prepare our case and bring it before the proper tribunal. Pending the decision which we are very sure of obtaining from the court, we are pleased to refer all inquiries on the subject to our attorneys as to the scope of the patents, their validity, and the chances of our maintaining them.

For the last year I have been giving the broadest publicity to our claims by directions of our counsel, so that cities, towns and institutions would not innocently infringe upon us. We are prepared to prove before any tribunal that Mr. Glover discovered septic action and patented the apparatus to take advantage of his discovery of a natural law.

Any patent lawyer will inform Mr. Osgood that it was not possible to renew the patent on septic action, but that it was pos-

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sible to patent an improvement. There is a question whether the first patent would have been sustained; there is no question according to our legal advisers, that the second patent is valid and can be sustained.

JOHN N. McCLINTOCK,
President and Manager.

League of American Municipalities, Meeting at Charleston, S. C.

(From Special Editorial Representative.)

The last annual meeting of the League of American Municipalities, held at Charleston, S. C., Dec. 12-15, was a pronounced success, both in point of numbers and the interest shown in the proceedings. The papers presented were all of a practical turn and the discussions were profitable. Of the various addresses of interest we present elsewhere the able papers of City Electrician Edward B. ENicott on Chicago's Lighting Plant, Controller Bird S. Coler on Remuneration to Cities for Franchise Rights, and Mayor George R. Perry on Public Water Supplies.

The election of Mayor Johnson of Fargo, N. D., was a tribute to his personal popularity and gave universal satisfaction. The location of the next convention at Jamestown, N. Y., however, called for considerable criticism as it was the result of active lobbying on the part of the Jamestown delegation and the skillful manipulation of the right of voting by proxy. While Jamestown will be a point convenient of access, in view of the exposition and the meeting of other societies interested in municipal matters, a change by the board of directors to Buffalo would be profitable, would inspire appreciative comment and action by many interested in the objects of the society, and would tend to emphasize the practical as of more importance than the social purposes of the organization.

The following resolutions were adopted by the convention as expressions of its views on the important topics covered:

Whereas, About one-twelfth of the whole population of this country is domiciled in cities of more than eight thousand inhabitants; and,

Whereas, There is scarcely a state in this union which does not have within its borders one or more cities the government of which requires the solution of more difficult and important questions than the government of the states in which they are situated; and,

Whereas, The fundamental principle of our free institutions is local self-government; and,

Whereas, Improvement in municipal taxation is practically impossible so long as taxation must be equal and uniform throughout each state; and

Whereas, The constitution of most of the states demand the uniform taxation of all property; and state revenue, in excess of that derived from specific taxes, is now raised by an effort at uniform tax on all property, which in practice is grossly unequal and unjust. Now, therefore, be it

Resolved, That all provisions in state constitutions should be abolished which restrict the power of the legislature to regulate assessment and taxation.

Resolved, That so much state revenue as may be required in excess of that derived from specific taxes should be apportioned to and paid by the counties or towns in proportion to county or town revenue.

Resolved, That every county or town and every city be granted the right to regulate the assessment and taxation of property at its discretion, provided any increase or reduction of assessment must be uniform throughout such county, town or city, and not made on the ground of ownership.

Resolved, That the executive officers of this league be instructed to co-operate with other like-minded associations or persons to secure the enactment of measures in harmony with these resolutions.

Another resolution adopted was as follows:

Whereas, It is desirable to have all the information possible on the subject of such important and rapidly-growing monopolies as water and gas, electric light, telephone, street railways, subways, conduit systems, pipes and wires, in and underneath our streets, whether such monopolistic enterprises are in the hands of the city or private owners.

Resolved, By the League of American Municipalities, That it urge upon the United States industrial commission the fullest possible investigation of the subject.

The following resolution of thanks was offered for the city of Charleston:

We, the delegates of the American League of Municipalities, in convention assembled, do hereby extend to the mayor, city officials and Freundschafts Bund, and to all the citizens of the old historic city of the South, the city of Charleston, our hearty appreciation of the hospitable manner in which we have been entertained, and we will, all of us, carry to our homes only pleasant recollections of the whole-souled reception extended to one and all, and our only regret is that necessity compels us to terminate at so early a day a visit that has been not only pleasant, but instructive, and the wish of all members of the League of American Municipalities that the citizens of Charleston may meet in the future that full measure of success that is due to them as a God-fearing, liberty-loving people of our united country.

The Hon. T. A. Johnson, mayor of Fargo, N. D., presented a paper on "The Contract System for Street Improvements—Should Such Improvements as the Construction of Sewers, Water Works, Sidewalks, Pavements, Grading, Etc., Be Done Under the Contract System or by the Municipality as the Employer of Day Labor?" Many figures were given to show the great variations in contract prices of street paving and sewers in various cities. He also makes comparisons between cost of pavements and sewers, with consideration of some differences in conditions, as done by days' labor in Minneapolis and as done by contract in St. Paul and in Fargo. He draws the conclusion that the contract

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system is more advantageous to the city so far as the cost is concerned, and presents some statements to show that one reason for this is the effect of political manipulation upon the quality of service of municipal employes.

Among the topics for discussion were the following: "Sewage Disposal Problems," with paper by M. N. Baker, New York City, and discussion led by A. D. Thompson, Peoria, Ill.; "Street Sprinkling and Cleaning—Should It Be Done by the Municipality or by Contract? What System Gives the Best Satisfaction?" The Hon. W. C. Maybury, mayor of Detroit, Mich., led the discussion. "The Best Method for the Assessment and Collection of Taxes, and the Limitation in the Taxing and Debt-Creating Powers of Municipalities," with papers by the Hon. John B. Weakley and Lawson Purdy and discussion led by the Hon. Alex Harrison, mayor of Hartford, Conn. Mr. Purdy thinks the most serious obstacle in the way of reform in methods of taxation and assessment is in the constitutions of the states which require certain methods of taxation, whereas he considers that these methods should be subject to change with the changes in our conditions and mode of life. Instead of a uniform tax for state purposes throughout the state, Mr. Purdy would distribute the revenue for state purposes among the counties in proportion to the revenues raised by the county. Economical counties would thus pay less of the state tax than at present, while counties and towns which are extravagant, and those which are progressive and are making material improvements as well, will pay more than they do at present. The advantage is claimed to be in the diminution of the temptation to undervaluation of property, which is now so serious a difficulty to state boards of equalization. Mr. Purdy would give every city the right to formulate its own system of taxation. He would assess real estate annually and abolish all taxation on personal property.

Other discussions were upon the following subjects: "Street Paving—What Are the Relative Merits and Cost of Various Paving Materials?" with papers by S. F. Crabbe, cy. engr. of Fargo, N. D., and Geo. W. Tillson, cy. engr. of Brooklyn, N. Y., and discussion led by the Hon Jas. K. McClure and the Hon. C. T. Driscoll, mayor of New Haven, Conn. "Boards, Single Headed Commission or Council Committees—Should the Administrative Affairs of the Departments of Public Works, Water, Fire, Police, Parks, Charities and Corrections be Conducted by Boards, Single Headed Commission or Council Committees?" led by the Hon Samuel J. Swartz, mayor of Columbus, O. "The Special Assessment System for Public Improvements—How Should Assessments be Levied? What Portion of the Cost of Public Improvements Should be Assessed Against Property Benefited, and what Portion Should be Paid from the General Taxes? How Should the Cost of Improvements at Street Intersections be Assessed, or Should It be Paid from the General Taxes?" led by the Hon. Paul Capdeville, mayor of New Orleans, La. "Public Water Supplies—What Means Should a Municipality Employ to Supply Its People with an Ample Supply of Pure Water at Equitable Rates? Is the General Use of Meters Desirable? What Systems of Filtration Are Satisfactory?" with paper by the Hon. Geo. R. Perry, mayor of Grand Rapids, Mich., (given elsewhere in this issue), and discussion led by the Hon. J. J. Hartenbower, mayor of Des Moines, Ia. "The Uniformity in Municipal Accounting," with papers by James Blake Cahoon, pres. National Electric Lighting Association, Syracuse, N. Y., and H. B. Henderson, State Examiner of Public Accounts, Cheyenne, Wyo.

Other features of the convention were addresses and papers delivered as follows: "The Prevention of the Introduction of Epidemic Diseases in the United States," Dr. Wm. F. Brunner, Health Officer, Savannah, Ga.; "A Practical Illustration of Municipal Ownership in a New England Community of 10,000 inhabitants," which we will print in a following number, by Thos. C. Perkins, consulting engineer, Hartford, Conn.; "Some Present English Municipal Conditions," by Prof. Edw. W. Bemis, late of Chicago University; "Municipal Expansion," by Clinton Rogers Woodruff, Philadelphia, Pa.; "The Fire Departments of Our Cities," by Frank C. Mason, supt. Police Telegraph, Brooklyn, N. Y.; "Garbage Disposal," by M. Craven, Sanitary Inspector, New York City.

Officers were elected as follows: President, J. A. Johnson, mayor of Fargo, N. D.; secretary, John MacVicar, ex-mayor of Des Moines, Ia.; treasurer, Thos. Taylor, ex-mayor of Bridgeport, Conn. The change in the control of the society may result in its benefit. Mr. Johnson is a valued member of the society, and Mr. MacVicar has long been one of its most enthusiastic supporters.

Technical Society Meetings.

The twenty-second annual convention of the Michigan Engineering Society will be held at Ann Arbor, Mich., Jan. 8, 9 and 10. Committee reports will be received on the following subjects: "The Relation of Sewerage and Water Supply to the Public Health," "Forestry," "Suggestions as to Engineering Features of Municipal Work to Be Protected by Ordinance," "Roads and Paving," "Advertising," "Ohio and Northwest Territory Centennial Exposition," "The Clark Monument." At the recent annual meeting of the board of directors of the society officers were elected as follows:

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President, H. E. Riggs, Toledo, O.; vice-president, Wm. B. Sears, Saginaw, Mich.; secretary and treasurer, F. Hodgman, Climax, Mich.; directors, H. R. Vedder, Agricultural college, Mich.; Dorr Skeels, Grand Rapids, Mich.

The regular meeting of the Engineers' club of Minneapolis was held Nov. 19. City Engineer Sublette presented a paper on "The Light and Power Plant at Austin, Tex." Papers for the coming season were announced as follows: "Experience of an Engineer as a Contractor," R. E. Howe; "City Engineers' Annual Reports," E. R. Dutton; "Native and Imported Cements for Sidewalks," Albert Dealing; "Electric Light and Power Plant," C. L. Pillsbury; "Future Disposition of Sewage in Minneapolis," Carl Ilstrup; "Pumping Engines," Prof. H. E. Smith; "Jumbo Pumps in Rectangular Arrangement for Electricity and Steam," William Redfield; "City Surveying," Ben Durham; "House Numbering for Cities and Towns," James Carroll.

The fifteenth annual meeting of the National Brick Manufacturers' Association will be held at Old Point Comfort, Va., Feb. 4 to 9, 1901.

The Illinois State Electrical Association held its first annual meeting recently, electing officers as follows: President, J. D. Gerlach, Chester; vice-president, C. B. Hillman, Barry; secretary, H. E. Chubbuck, Quincy; treasurer, D. Davis, Litchfield.

The American Institute of Electrical Engineers held its one hundred and forty-eighth meeting in New York City Nov. 23. A report of the committee on the establishment of a national standardizing bureau was submitted urging the establishment of the bureau, which was unanimously adopted.

The Engineers' club, Columbus, O., held a meeting Dec. 1, when an address was delivered by Prof F. C. Caldwell of the State university, on "Storage of Electricity and Its Application to Practical Work."

At a meeting of the Western Society of Engineers, Chicago, Ill., Dec. 5, Prof. A. N. Talbot of the University of Illinois read a paper on "Recent Progress in Sewage Purification."

The annual meeting of the Connecticut Civil Engineers and Surveyors association will be held in Hartford, Conn., Jan. 8.

The forty-second meeting of the American Society of Mechanical Engineers was held in New York City Dec. 4 to 7. Among the papers presented was one by F. W. Dean, on "The Power Plant of the Massachusetts General Hospital." Officers were elected as follows: President, Samuel T. Wellman, Cleveland; vice-presidents, David Townsend, Philadelphia; Stevenson Taylor, Hoboken; Jesse M. Smith, New York City; Arthur M. Wiatt, New York City; James M. Dodge, Philadelphia, and Ambrose Swasy, Cleveland; treasurer, William H. Wiley, New York City.

The American Society of Civil Engineers, New York City, will hold a meeting Jan. 2, when C. R. Grimm will present a paper on "The Kinzua Viaduct of the Erie Railroad Company." The annual meeting of the society will be held Jan. 16 and 17.

The Michigan Engineering society will hold a meeting at Ann Arbor, Jan. 8 to 10.

The Northwestern Electrical association will hold its annual meeting in Milwaukee, Wis., Jan. 16 to 18.

The Ohio Society of Surveyors and Civil Engineers will hold its annual meeting in Columbus Jan. 21 to 23.

The Illinois Association of Corporation Counsels and City Attorneys at its semi-annual meeting held in Peoria, Dec. 4, devoted itself largely to the discussion of amendments to the laws of cities, and concerning street assessments. The division of the number of payments for street improvements into ten was decided upon, reducing the interest rate to 6 per cent., and providing that no interest be paid until the improvement is completed. It is held, also, that cities have the right to regulate the prices of gas and light. A committee was appointed to visit Springfield and urge the legislation suggested.

The American Economic Association held its thirteenth annual meeting at Detroit and Ann Arbor Dec. 27-29. The subjects included The Taxation of Quasi-public Corporations. History and Problems of Colonization, Commercial Education, Uniform Municipal Accounts and Statistics. The latter subject was presented in the form of a committee report by M. N. Baker, chairman, and continues the discussion of this subject on lines parallel with those followed in the summer meetings of the Municipal Improvements and Engineering Societies. Richard T. Ely was president and Charles H. Hull of Ithaca, N. Y., secretary.

The Indiana Society of Engineers and Surveyors will hold its next meeting at Indianapolis Feb. 14-16. An interesting program for both engineers and surveyors is in preparation and will be announced in our next number. J. S. Spiker, Vincennes, is president.

The next annual meeting of the Illinois Society of Engineers and Surveyors will be held at Bloomington, Jan. 23 to 25. The preliminary program is attractive and indicates that the meeting will be up to the high standard set by this society. This is due to the efficient work of the executive secretary, Prof. M. S. Ketchum of Champaign, and to the chairmen of the various committees. There will be several papers upon railroad subjects, one on the calculation and staking out of earth work by A. L. Kuehn, and one on office filing records and index by R. C. Vial, having considerable general interest. Prof. I. O. Baker

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will discuss the cost of wagon transportation, Prof. N. C. Ricker the effects of the license law for architects in Illinois, and Prof. G. A. Goodenough the effect of curvature on the strength of machine parts. Of special interest to municipal engineers will be "Modern Brick Pavements," by W. H. Tarrant, city engineer of Champaign; "The Building of a New City," by Burton J. Ashley, chief engineer of Zion City. Other papers on land drainage, a topographic map of the state, etc., are promised, and one by Prof. A. N. Talbot. The proposed bill for licensing Illinois land surveyors will be discussed.

Under the auspices of the Indiana State Board of Commerce the members of the Indiana Municipal League held a conference in Indianapolis Dec. 6. The conference was for the purpose of discussing better municipal government in the smaller cities and towns. An informal address was made by A. L. Mason of Indianapolis on "The Best Charter for the Smaller Cities of Indiana." The program committee recommended the permanent organization of the conference by the election of a president, secretary and executive committee. Under this recommendation the executive committee is to draft a bill along the line proposed in the conference, and make a report at a future meeting of the organization. Upon the adoption of this bill it will be presented to the state legislature this winter.

Excessive Advertising of Certain Improvements in Washington.

A bill relating to the assessment and reassessment of water main taxes in the District of Columbia has been submitted to the chairman of the senate and house district committees by the district commissioners with a recommendation that it be enacted into the law. The object of the bill is to relieve property-owners in front of whose lands water mains are laid from the excessive charge which the commissioners are now required to impose upon such land by the publication of the notice prescribed by the act of June 2, 1900. That law requires the daily insertion of the notice, Sundays excepted, for two weeks in two newspapers. The cost thus imposed frequently equals and often exceeds the actual cost of laying the main. The commissioners proposed to change the number of times of publication from two weeks to a publication once a week in each of two successive weeks and to supplement the publication by a personal service, such as is now given in the case of special assessments for sidewalks, alleys and the like.

Proposed Municipal Telephone Scheme Rejected.

A resolution was introduced in the common council of Detroit providing that a bill be drafted and presented to the next session of the Legislature, granting the city of Detroit the right to issue bonds to construct and operate a telephone system. This resolution was referred to the Committee on Charter and City Legislation. The report of this committee is published in the official proceedings of the common council for November 13, 1900, and is as follows:

To the Honorable, the Common Council:

Gentlemen—Your Committee on Charter and City Legislation, to whom was referred the resolution of Alderman Moeller, relative to considering the advisability of drafting a bill to be presented at the next session of the Legislature, granting the city of Detroit the right to issue bonds to construct and operate a telephone system, respectfully report that we have carefully considered the matter and that, according to the best judgment of your committee, such a step would be unwise, for the following reasons:

There is no reason, in the opinion of your committee, why the tax-payers of the city of Detroit should assume a liability of hundreds of thousands of dollars for the benefit of 7,000 or 8,000 telephone subscribers, or users of telephones.

The municipal ownership and operation of telephones would be entirely different from municipal lighting and water works, as the whole people receive the benefit from well lighted streets, and the city water supply is a necessity to every citizen, whereas:

In the case of a municipal telephone system all the taxpayers of the city of Detroit would assueme the total liability of the expense of the telephone system for the benefit of comparatively few telephone subscribers and users. In case of an annual deficit, which would not be improbable, the taxpayers of Detroit would again be called up to pay the same, thus making the people who do not use telephones pay a part of the expense for those who do, all of which is legislation in the interest of the few at the expense of the many.

Again, the municipal telephone system could be operated only within the city of Detroit and would have no connection with lines outside of the city, which would be a serious drawback.

Your committtee is aware of the poor service the present telephone company is now and has been giving for some time; however, the company is operating under an exceedingly lax ordinance, which provides no penalties for poor service, etc. There is no way to reach them until the ordinance expires, fourteen years hence.

After giving full consideration to this matter, your committee feels that it cannot consistently recommend any bill for the municipal ownership and operation of telephones.

Robert Van Buren's Report on Brooklyn Water Supply.

An exhaustive report has been submitted by Robert Van Buren, engineer in charge of the Brooklyn water supply, in which he reviews the various steps taken to conserve the limited supply of that borough and also touches upon the requirements of the future. He is opposed to driven wells as sources of

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permanent supply, and recommends a supply from the Housatonic water shed. The introduction of meters is advocated.

A Municipal Lodging House Proposed by Chicago's Mayor.

The establishment of a municipal hotel is proposed by Mayor Harrison of Chicago, who has requested an appropriation of $20,000 for such an institution. His plans contemplate the furnishing of 300 bed-rooms, which will be open to men able to prove good character and the need of help. It is not intended that the hotel should offer permanent quarters to its guests, and it is expected that it will relieve the police stations of the better class of men, who have been forced by poverty to take refuge in them in extreme weather.

Washington Medical Society Recommends Sand Filtration of Water Supply.

The adoption of sand filtration is urgently recommended in the report of the committee appointed by the Medical Society of the District of Columbia to investigate and report on the prevalence of typhoid fever in the District. The report says:

Wherever a proper system of slow sand filtration has been installed, the mortality from typhoid fever has been reduced from 50 to 75 per cent., and there is every reason to assume that the same result can be accomplished in this city. An experimental sand filter eliminated 50 per cent. of the colon bacilli, which are an accurate index of the presence of disease germs and by many classed as such.

The cost of a filtration plant is estimated at $2,461,338, with an annual operating expense, including interest on cost of plant and deterioration, of $186,402.27. The first cost may be safely reduced by $530,310 by omitting the covering of the filter beds, as suggested by the experts employed by the war department, which would effect a reduction of about $22,980.10 per annum in the operating expenses.

Apart from the saving effected by constructing open instead of closed filters, it is believed by your committee that the germicidal effects of sunlight operating on the open filters will render them far more efficient than if they were covered.

The first cost of a mechanical system of filtration, on account of the limited amount of land required, is approximately only $1,081,377, but it has been found that while, in general, sand filters improve with age, the operating expenses and deterioration of a mechanical system are very much the greater.

The committee considers that the most important aspect from which the two methods of filtration shall be compared is in their relation to public health, and more particularly in relation to what they have accomplished in the reduction of typhoid fever mortality in cities where they have been employed. Their investigations lead them to decide in favor of slow sand filtration rather than mechanical filtration, and to declare mechanical filtration a method, a chemical process, requiring constant exercise of the greatest nicety and the utmost care, the results of which some of its warmest friends admit are unsatisfactory without such care. Of sand filtration it says:

Whatever the merits of the mechanical system of water purification may be, the burden of proof as to its capability of diminishing typhoid fever clearly rests with this method, which, we regret to say, has so far failed to sustain this claim, and your committee, in view of the evidence in favor of sand filtration, which has stood the test with increasingly good results for over a half century, furnishing now the daily supply of water to more than twenty millions of people, would deem it an unwise experiment to resort to mechanical filtration of our city's water supply.

Financial Standing of St. Charles, Mo.

The citizens' committee on water works, at St. Charles, Mo., sent out a circular letter Dec. 22, the purpose of which is to defend the name of that town against another circular letter, dated Dec. 5, sent out by Edward Gut, in which the credit of the city was attacked. His object was to defeat the sale of the water works bonds which are about to be issued to an amount not exceeding $115,000. Th circular of the citizens' committee calls attention to the fact that the question of the validity of the extension of the city limits made in 1894, under the laws of 1893, has been fully investigated by the city authorities, and is held valid by the state attorney-general; that the legal voters of the city voted to issue bonds for municipal water works; that the city has never yet defaulted in its obligations, and that its credit stands clear and unimpeached.

A Suit for Hydrant Rental.

Judge McPherson of the United States court, at Keokuk, Ia., rendered a decision Dec. 19 in the case of the Ft. Madison Water company vs. the city of Ft. Madison, in which suit was brought for $4,528.90 for hydrant rental. The city claimed that under the city ordinance the hydrant rental was to be paid quarterly out of the special tax fund to be levied and collected for this purpose; that the 5-mill levy required by law was not sufficient to pay the hydrant rental and all amounts in excess of the special levy of 5 mills was void and not binding on the city.

Judge McPherson holds that only a fund is created which is to be applied on the contract price and not in extinguishment of the contract price. The demurrer of the plaintiff is sustained and judgment rendered against the city for the amount sued for.

Decision on Electrolysis Case in Indianapolis.

Judge Carter, of the superior court, Indianapolis, Indiana, overruled the demurrer

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in the suit of the Manufacturers' Gas company against the Indianapolis Street Railway company for $50,000 for damages alleged to have been done to the gas company's pipes by electrolysis. In ruling upon the demurrer, Judge Carter says:

"Where a corporation is exercising a public franchise and does so in such a manner as to cause actual material injury to legal rights and destruction of property when at reasonable expense, by the adoption of well-known and approved appliances, the injury could be avoided, and the person injured is powerless to prevent or guard against such injury, then I think it must be held to be negligence in the use of its franchise on the part of such corporation not to adopt such approved appliances."

New Publications.

Water Power, an outline of the development and application of the energy of flowing water. By Joseph P. Frizell, hydraulic engineer, M. Am. Soc. C. E. 563 pp. John Wiley & Sons, New York.

Mr. Frizell recognizes the fact that water power will obtain a new lease of life, that its use will receive a great impetus from the improvements in transmission of electrical energy. A book devoted to the theory of hydraulic machinery and the practice of the construction and operation of the appurtenances and the machinery of hydraulic installations is therefore timely. Mr. Frizell is equipped both by study and experience for writing such a book and has covered the field probably with sufficient minuteness for the ordinary student and engineer engaged upon the solution of hydraulic problems. Greater detail of equal value can only be obtained in extended monographs upon special divisions of the subject. More detailed notice of special chapters and features of the book will be made from time to time as occasion offers.

The book includes also chapters upon the transmission of energy developed at the hydraulic plant, eighteen pages being given to mechanical transmission by shafting and wire rope, fourteen to hydraulic transmission, eighteen to compressed air, fourteen to the electric current. The use of steam power in reserve is compared with the use of reservoirs en considerable detail. There is a short chapter on the computation of damages to mill owners.

A general view of the book, which has just been received, indicates that it is a valuable contribution to modern engineering literature.

The Progress of Invention in the Nineteenth Century. By Edward W. Byrn, A. M., 476 pp., cloth, $3. Munn & Co., 361 Broadway, New York.

The author claims for this book "simply a cursory view of the century in the field of invention, intended to present the broader bird's-eye view of progress achieved." His main facts are derived from the best of authorities, the patents for the inventions chiefly. Electricity takes nine chapters; steam, three; printing and the typewriter, one each; labor saving machinery, four; chemical processes of various kinds, five; food and drink, medicine, modes of locomotion, optics, civil, mechanical and military engineering all find their places. A chronology of the most important inventions occupies eight pages. The author is quite too modest in his claim, for while very little space can be given to any one class of inventions, the text and illustrations are so chosen as to make the most of the pages occupied. There must be omissions in so small a book on so great a subject, and we cannot all agree upon what are the proper omissions to make, but we can accept with pleasure the facts that are so concisely stated and so beautifully clothed.

The Law of Operations Preliminary to Construction in Engineering and Architecture. Rights in Real Property, Boundaries, Easements and Franchises. For Engineers, Architects, Contractors, Builders, Public Officers and Attorneys at Law. By John Cassan Watt, M. C. E., LL. B., Attorney and Counselor at Law and Consulting Engineer, M. Am. Soc. C. E., 638 pp. Cloth, $5; sheep, $5.50. John Wiley & Sons, New York.

This is in reality a second volume of the author's earlier "Engineering and Architectural Jurisprudence." The first volume presented the law of construction, and this volume presents the law concerning the operations which precede construction. The two volumes, together with Mr. Johnson's book on engineering contracts and specifications, should prepare the engineer to understand the principles of law upon which he must proceed, and, except where special statutes intervene, to keep in a line of action which will be technically correct from a legal point of view.

Theaters: Their Safety from Fire and Panic, Their Comfort and Healthfulness. By William Paul Gerhard, C. E., 110 pp. Cloth, $1. Bates & Gould company, 15 Exchange-st., Boston. Mass.

The author takes up in detail the question of safety and shows means by which present unsatisfactory conditions may be remedied, and discusses the following topics: Means of escape; measures tending to prevent fire and for quickly detecting and signaling one which may occur; protection of the audience and stage personnel from fire and smoke; localizing and restricting fire; means for saving life, fighting fire and guarding against panic. Under comfort and sanitation the following topics are treated in like manner: The unsanitary condition of theaters; ventilation, heating and lighting; floors, floor coverings, walls, ceilings and furniture; dressing-rooms; drainage, plumbing and water supply; removal of refuse; cleaning, dusting and sweeping; and periodical sanitary inspection.

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Personal.

Col. Francis G. Ward has been elected commissioner of public works at Buffalo, N. Y.

R. E. Slade has resigned his position as superintendent of the Tampa Water Works company, Tampa, Fla.

E. J. Ellis has resigned his position as manager of the Macon Gas Light and Water company, Macon, Ga.

Ralph Moore, C. E., Cambridge, Mass., has gone to Cuba where he will practice civil engineering.

Joseph S. Swindell has been appointed assistant engineer of the New York Aqueduct commission.

Asa M. Mattice has been appointed chief engineer of the Westinghouse Electric and Manufacturing company.

Dow R. Gwinn, superintendent of the Quincy Water Works, Quincy, Ill., made a recent visit to Mexico.

J. Wesley Seaman has been elected city surveyor, at Long Branch, N. J.

Robert Leigh MacMurdo, secretary of the New Orleans Water company, died of paralysis Dec. 12, aged fifty-six years.

John J. Grafton has been appointed water works trustee to succeed Hugh Anderson, resigned, at Wellsville, O.

Frank M. Sylvester has been promoted to the office of assistant engineer in the department of bridges, New York City.

B. F. Hewit has resigned his position as city engineer of Conneaut, O., to accept that of village engineer at Geneva, O.

F. A. Coleman, city engineer of Rome, N. Y., has been appointed superintendent of the Valley Coal & Coke company, at Belington, W. Va.

Alexander W. Cooke, formerly a city engineer of Chicago, Ill., died Nov. 22 at Havana, Cuba, of yellow fever, aged forty-five years.

Russell R. Stuart, ex-city engineer of Syracuse, N. Y., will remove to Denver, Col., where he is interested in mining enterprises.

Col. Thomas W. Yardley, manager of the cast iron pipe department of Robert W. Hunt & Co. of Chicago, died in that city Nov. 21, aged seventy-six years.

D. W. Cole has resigned his position in the Metropolitan water works of Massachusetts to join the staff of City Engineer Cairns at Waterbury, Conn.

F. A. W. Davis, president of the Indianapolis Water company, Indianapolis, Ind., testified as an expert Dec. 12 in the injunction suit of the Cedar Rapids Water company vs. the City of Cedar of Rapids, Ia.

Dr. Henry S. Hoepfner, consulting engineer and chemist of Hamilton, Ont., and well-known through his invention of the electrolytic treatment of refractory ores, died recently in Denver, Col., of typhoid fever.

Charles W. Gay, M. Am. Soc. C. E., and formerly city engineer of Lynn, Mass., has been appointed a member of the board of public works of that city for two years. The charter providing for a board of public works in Lynn was only recently adopted.

P. F. Brown, formerly city engineer of Janesville, Wis., and C. M. Kurtz, until recently a civil engineer in the maintenance of way department of the N. Y. C. & H. R. railroad, have formed a partnership and will practice civil engineering in San Francisco, with offices in the Mills building.

Washington H. Lawrence, president of the National Carbon company, Cleveland, O., died suddenly at his home at Dover Bay Nov. 23 of heart failure superinduced by the operations attendant upon the amputation of his arm. Mr. Lawrence was associated with Charles F. Brush in the organization of the Brush Electric company.

MACHINERY AND TRADE.

The Dady Contract at Havana.

Michael J. Dady has made a statement denying that $50,000 had been offered to Mayor Rodriguez of Havana, Cuba, with a view of influencing his decision in the awards made recently to Mr. Dady as owner of the sewer project in that city, and for expenses entailed since submitting his plans to the old municipality in 1895. Mr. Dady says that if anyone will make affidavit fixing the responsibility for the slanderous accusations, he will take steps to procure the arrest and prosecution of the instigator, even if he should prove to be the mayor. As far as the contract is concerned, Mr. Dady will fight it to the finish.

Consolidation of the National and American Asphalt Companies.

The National Asphalt company in an answer to an injunction suit of H. C. Spinks against the consolidation with the Asphalt Company of America, says that Mr. Spinks is too late; that the deal has been consummated; that the National now holds 589,000 of the 600,000 shares of the American company; that the deal was closed on Sept. 18, when the stock was surrendered by a majority of the American stockholders; that other stockholders have since made the exchange; that the deal is a just and equitable one for the American stockholders; that the National company is able to pay the interest, and that the deal is mutually profitable.

Decision is reserved by Vice-Chancellor Emeror.

The Addressograph.

One of the latest devices for lightening the labors of the office man is the addressograph, a machine for printing addresses upon envelopes for papers, magazines, or advertising matter. It is a great saver of time where mail matter is sent frequently to the same addresses, hours being required with the machine where days are required when the work is done by hand. It is small,

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efficient, durable and gives satisfaction, as this office can testify. It is made by the Addressograph Company of 171 S. Canal St., Chicago.

Trade Notes.

ASPHALT.

The Truxell & Hensell Asphaltum company of Chattanooga, Tenn., has been incorporated by C. H. Hensell, Ben S. Truxell, A. E. Davenport, W. H. Ballew and S. B. Smith. The company has located a new asphalt deposit sixty-five miles west of Louisville, Key. The material will be refined at Chattanooga.

BRICK.

The Missoula Brick and Cement company, Missoula, Mont., has been incorporated to manufacture fire brick, paving and building brick, cement, clay pipe, tiling, etc. The incorporators are R. M. Cobban, A. C. Hollenbeck and A. E. Pond.

The plant of the Canton & Cleveland Brick company, at Waco, O., three miles from Canton, was totally destroped by fire recently, entailing a loss of $50,000. A new plant will be built at once. The plant was built about fifteen years ago, and was one of the first brick paving plants in that section. Shortly after it was built it was sold to J. H. Highley and H. S. Bellew, who enlarged the plant. It was called the Canton Brick company until about two years ago, when the Canton plant was consolidated with another brick plant at Wilber, near Cleveland. It was then incorporated with a capital stock of $200,000, and was called the Canton & Cleveland Brick company. J. L. Highley of Highley, Keplinger & Co., is one of the heaviest owners.

CEMENT.

The Cumberland and Potomac Cement company, Cumberland, Md., has awarded contracts for the erection and equipment for its proposed works to John Stacks & Sons of Baltimore for $40,000.

The Consolidated Cement company has awarded contracts for five new kilns, engine house, mill and warehouse at its plant north of Whitefish Bay, Wis., at a cost of $25,000.

A slag cement plant is being erected at North Birmingham Iron company and the Sloss Sheffield Steel and Iron company.

The Stoddard Portland Cement company, Detroit, Mich., has been incorporated.

A cement plant will be installed on the farm of W. K. Rothinberger, near Reading, Pa.

L. C. Vogelsang and L. F. Baines are the promoters of a new Portland cement plant to be erected at Wellston, O.

The Charles W. Goetz Lime and Cement company, St. Louis, Mo., has been incorporated by Louisa A. and Marie E. Goetz and Phillip J. Dauernheim, trustee.

A cement storage worehouse is proposed for the District of Columbia, from which will be drawn all cement used in public works of the district.

A company has been incorporated by T. Best, W. F. Dendy, P. A. Simmons and others, which will operate a Keene's cement mill at Glade Springs, Va.

The Portland cement plant of William Krause & Sons, at Martin's Creek, Pa., was damaged by fire Nov. 26, entailing a loss of $150,000. The fire originated in the coal house, destroying that building, the storage and the finishing buildings.

The Keene's White Cement company, New York City, has been incorporated by Louis Fin, 87 Franklin-st., Brooklyn, and Max and Seymour Hermann, 161 W. Ninety-fifth-st., New York City. The works will be located at Long Island City.

A Belgian stock company has been formed in Egypt to manufacture cement at Massara on the Nile, near Cairo.

A steam power plant will be installed by the Helderberg Cement company of Howes Cave, N. Y.

The Standard Portland Cement company, Detroit, Mich., has filed articles of association and will be capitalized at $1,000,000. The company has control of 000 acres of valuable marl and clay lands near Hamburg Junction, Mich., where a plant will be built. The officers of the company are: President, George H. Barbour, Detroit; vice-president, John Cutty, Windsor, Ont.; secretary, George E. Moody, Detroit; treasurer, M. L. Williams, Detroit. The present offices of the company are in the Hammond building, Detroit.

The Russia Cement company, Gloucester, Mass., is enlarging its plant.

The Douglass Sellers Cement company has purchased large tracts of marl lands in Sugar Loaf and Mud lakes, two miles north of Schoolcraft, Mich., and will erect at once a large cement plant. About $400,000 will be expended.

A marl bed of 1,100 acres, recently discovered near Aral, Benzie county, Mich., is being investigated by L. C. Waldo and E. W. Sprague of Detroit, and W. W. Hull of Cleveland, and if suitable clay deposits are found in the neighborhood a cement plant will be erected.

The erection of a large cement plant at Rushsylvania, O., is contemplated by Andrew Amerine of Fostoria, Bruyler Bros. of Big Springs, G. L. Maddox and Kenyon Bros. of Harper. The company has secured control of 221 acres of marl in Logan county, located near Rushcreek lake.

A large cement plant will be erected at Riverside, N. J. Henry Diefenderfer of Reading, Pa., is at the head of the company.

The cement works of T. Millen & Sons, Wayland, N. Y., has been purchased by a syndicate of New York capitalists. The works will be enlarged.

A new cement plant is being built at Ludlow, near Ithaca, N. Y.

C. A. Nimocks of Minneapolis, Minn., is said to be at the head of a project to establish a new Portland cement plant at Bedford, Ind.

The erection of a large cement plant is proposed by an Eastern syndicate if a suitable bed of clay can be found near the limestone quarries of Roche Harbor, Puget Sound, according to press reports.

The Calumet Portland Cement company will construct a building at Thirty-ninth-st. and Lowe-ave., Chicago.

The erection of a large cement plant in Crawford county, Indiana, near Milltown, or Marengo, is contemplated by V. O. Foulk, a capitalist of Cleveland, O. State Geologist Blatchley says the oolite deposits in that county are rich in carbonate of lime, the

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chief ingredient of Portland cement.

Little Rock, Ark.—Sealed bids are asked until Jan. 2, 1901, for furnishing 11,000 barrels of American Portland cement. Robt. McGregor, Capt. U. S. engrs.

The Hutchinson Ransome company, Oakland, Cal., has been incorporated to conduct a concrete cement business. The incorporators are T. R. Hutchinson, Dwight Hutchinson, Bernard Ransome, Wm. B. Pringle and Chas. W. Snook.

The erection of a large cement plant at one of the seven lakes near Hudson, Mich., is proposed by a Chicago syndicate, according to press reports.

ELECTRIC LIGHT COMPANIES.

The North Milwaukee Electric Light company has been incorporated and will take charge of the electric lighting business formerly carried on by the Meiselbach company, which had a contract for lighting that village.

A syndicate of Philadelphia capitalists is endeavoring to secure control of the Crescent City Gas works of New Orleans, La., and the entire plant and franchises of the company for the remaining twenty-five years that the franchise has to run. H. D. Pearson of Philadelphia represents the capitalists.

The American Light, Power and Transportation company has been incorporated to operate street railway, gas and electric light plants in the state of New York. Chas. M. Warner, Henry S. Holden, Lyman C. Smith, Wm. Nottingham and C. B. Beebe of Syracuse, N. Y.

The American Street Railway Generating and Power company, East Orange, N. J., has been incorporated by Edw. G. Johnson, Franklin B. Palmer and Jos. F. Tron.

The proprietors of the Peoria Gas and Electric company, Peoria, Ill., have certified to an increase in the capital stock from $500,000 to $1,000,000. It is believed that this means that active opposition between the gas and electric light interests is at an end.

The South Jersey Gas, Electric and Traction company has absorbed the Trenton Gas and Electric company, of Trenton, N. J. Other gas properties owned by the company are those of Camden, Stockton, Woodbury, Merchantville, Moorestown, Mt. Holley, Haddonfield and Gloucester.

Newly incorporated companies: Des Moines Edison Light company, Des Moines, Ia., electric light business; Dyersville Light and Water company, Dyersville, Ia., light and water business; Waterford Electric Light, Heat and Power company, Ballston Spa, N. Y.; Fruit Vale Light, Heat and Power company, Fruitvale, Cal., supply light, heat and power; Southern Light and Power company, Vicksburg, Miss.; Hood River Electric Light, Power and Water company, Hood River, Ore.; New Jersey Light, Heat and Power company, Camden, N. J.; Citizens' Gas and Electric Light company, Council Bluffs, Ia.; Barrington Electric Light and Power company, Barrington, Ill.; Mayfield Electric Light, Heat and Power company, Mayfield, N. Y.; Transcendent Light company, Jersey City, N. J.; Geddes Light and Water company, Geddes, S. D.; Long Island Electric, Gas and Water company, Camden, N. J.; United Light and Power company, Dover, Del.; Mead Electric company, Marion, Ind.; Merchants' Electric Light, Heat and Power company, York, Pa.; Citizens' Light, Gas, Heating and Power company, Danville, Ill.; Citizens' Gas company, Dunkirk, Ind.; State Lighting company, Jersey City, N. J.

WATER.

Charters were granted to water companies in Allegheny county, Pennsylvania, Nov. 26, each company having the same directors and capital, as follows: Carrick Water company of Baldwin, office at Knoxville, Pa.; Scotia Water company, Jefferson township; Snowden Water company, Snowden township; Beachmont Water company, Collier township; Amity Water company, Mifflin township; Federal Water company, South Fayette township; Bridgeville Water company, Upper St. Clair township.

Application for charters will be made Jan. 3 in Pennsylvania by Pittsburg capitalists, for four separate water companies to be known as the Houston, the Murray, the Strabane and the Cecil companies. The object of the newly formed companies is to supply water for domestic and manufacturing purposes to the boroughs of Cannonsburg and South Cannonsburg, and North Strabane and Cecil townships. Joseph M. Wilson, H. A. Gilles, Charles W. Kiser, Enol Miller and John Y. Peters are interested.

Newly incorporated water compaies: Imperial Water company, No. 2, Los Angeles, Cal.; Vicksburg Water, Light and Power company, Pierre, S. D.; Upland Water company, North Ontario, Cal.; Kingally Tract Water company, Pomona, Cal.; St. Louis and Missouri River Water and Power company, St. Louis, Mo.; Chickasha Water and Electric Light company, Chickasha, I. T.; Hemit Water company, Hemit, Cal.; Cyclone Water company, Azusa, Cal.

MISCELLANEOUS.

The Schillinger Bros.' Co., Toledo, O., was incorporated Nov. 24 to do cement paving and roof work. The incorporators are Fred Schillinger, William Hummel, E. W. Schillinger, Fred A. Schillinger and William P. Tyler.

The manufacture of sidewalk tile is proposed by Dinnie Bros. of Grand Forks, N. D.

The United States Standard Voting Machine company, Rochester, N. Y., has been reorganized to manufacture and sell voting machines, and has purchased the United States patents and applications for patents, inventions, models, etc., of the Standard Voting Machine company of Rochester, N. Y., and the United States Voting Machine company of Jamestown, N. Y. The company now controls the manufacture of the only voting machines that have been used in presidential elections, other than in an experimental way, and the only machines that have been successfully used in successive elections in the United States.

The New York Bridge and Iron company, New York City, has been incorporated to construct bridges, etc., by A. E. Penble, J. Kenny and F. P. Kafka of New York City.

The Canadian Bridge company, Ltd., Walkerville, Ont., has been incorporated by B. S. Colburn, Francis C. McMath and G. F. Porter of Detroit.

The Automobile Street Sweeping company, Boston, Mass., has moved its offices

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to 185 Summers St., directly opposite the great terminal station. The company proposes to open the new century with an entirely new departure in city cleaning, sprinkling, etc.

The Southern Illinois and Missouri Bridge company, Chicago, Ill., has been incorporated by Myron J. Carpenter, Charles W. Hillard and Oliver S. Lyford.

The capacity of the plant of the American Bridge company at Youngstown, O., will be doubled.

The Lane & Bodley Works at John and Water Sts., Cincinnati, O., was burned Dec. 13, entailing a loss of from $200,000 to $250,000.

The plant of the Brown Hoisting and Conveying Machine company, Cleveland, O., burned Dec. 17, causing a loss of over $500,000.

F. A. Kalker was appointed receiver, Dec. 17, for the Northwestern Scraper company of Anderson, Ind.

William B. Scaife & Sons, Pittsburg, Pa., are constructing a steel frame extension for one of the boiler houses of the Pittsburg Coal company at Hazeltine, Pa. They also have the contract for a steel frame trestle and other structural steel work for the Pennsylvania Mining company, to be erected near Carnegie, Pa.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Duluth, Minn.—Mayor Hugo is said to be in favor of paving residence streets with a mixture of asphalt and macadam.

St. Paul, Minn.—Compressed asphalt blocks are being laid in a down-town alley subject to heavy traffic, as an experiment.

The December issue of Municipal Engineering stated that experimental strips of creosoted wood block pavement are being laid parallel with asphalt strips in Tremont-st., Boston, Mass. This is a mistake in that the wooden blocks, instead of being creosoted, are treated by the creo-resinate process of the U. S. Wood Preserving company of New York City.

North Tonawanda, N. Y.—A slag cement roadway will be constructed in the city by the Iron and Steel company, which secured permission to lay tracks on a certain road which was badly out of repair, on the condition that it slag the roadway for its full width of 65 feet. The company intends to run a "hot train" of iron cars filled with molten slag over the track, the slag being poured over the surface of the road as the train passes. When the slag cools the com-

CONTEMPLATED WORK.

pany claims that it will harden into a solid and even mass, thus forming a good slag cement roadway.

Toledo, O.—Macadam paving is proposed for Miami-st.

Petaluma, Cal.—Macadam paving is proposed for Dewey-st.

Brownsville, Pa.—This town has voted to pave the streets.

Franklin, La.—Bonds will be issued for street improvements.

Winona, Minn.—Superior-st. will be paved in the spring.

Chester, Pa.—Paving is proposed for Seventh and Eighth-sts.

Albion, Mich.—The question of street paving is being agitated.

Ripon, Mich.—Bids will be asked soon for improving several streets.

Aurora, Ill.—Main-st., in front of Lincoln park, will be paved.

Philadelphia, Pa.—Ordinances have been approved for paving ten streets.

Dickinson, N. Y.—Plans are being prepared for the extension of Front-st.

Napa, Cal.—A resolution has been passed to macadamize and gravel First-st.

Fonda, N. Y.—The road from Amsterdam to Minarith will be macadamized. Bd. supvrs.

St. Joseph, Mo.—Asphalt paving is proposed for Fourth-st. and Mitchell-ave.

New Britain, Conn.—The question of paving around the park with asphalt will be agitated.

Joliet, Ill.—Brick paving is contemplated for Washington-st. between Ottawa and Joliet.

East Peoria, Ill.—The question of paving a number of streets with brick is being agitated.

Topeka, Kas.—Paving is proposed for Western-ave., from Second to Sixth-ave.

Kansas City, Mo.—An ordinance is pending which provides for the widening of Main-st.

Oakland, Cal.—Resolutions have been passed to macadamize Twenty-fourth and Newton-aves.

Fredericksburg, Va.—Bids will be advertised for street paving. N. W. Davis, engr. Charlottesville.

Newport News, Va.—The council has recommended that Twenty-fifth-st. and the river road be macadamized.

Mobile, Ala.—The council has been authorized to issue bonds for paving and street improvements.

Terre Haute, Ind.—The residents on Cherry-st., from Second to Ninth, have petitioned for brick paving.

New Salem, Minn.—The question of issuing bonds for roads and bridges may be voted on.

Newfolden, Minn.—This town contemplates voting on the question of issuing bonds for roads and bridges.

Cincinnati, O.—Bids for $150,000 street improvement bonds will be received Jan. 10. Paul M. Mullikin, co. audt.

Pomeroy, O.—Bids will probably be received in May for about two miles of brick paving. M. H. Jenkinson, mayor.

Kansas City, Mo.—The board of public improvements has passed ordinances for paving nineteen streets with vitrified brick.

Moline, Ill.—The property-owners on Twentieth-st. are agitating the question of paving that street with asphalt.

Tamaqua, Pa.—The question of issuing bonds for the paving the streets will be voted on in the spring.

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Norwich, N. Y.—The question of paving Broad, W. Main. N. Broad and Lock-sts. is being considered by the board of trustees.

Elmira, N. Y.—Baldwin-st. and Railroad-ave. will be paved with brick or asphalt in the spring. Cy. Clk. Wyckoff.

Battle Creek, Mich.—A resolution has been passed preparatory to issuing $25,000 bonds for paving.

Hopewell, N. J.—The question of macadamizing a road from Belle Mead to Stroutsburg is being considered.

Denver, Col.—Superintendent McGilvray estimates that $35,000 will be required for street repairs next year.

Kirkwood, Mo.—An extensive plan is being considered for opening new streets and widening those that are narrow.

Portland, Or.—Brick or other durable paving is contemplated for Grand-ave. in the spring, according to local press reports.

Omaha, Neb.—City Engineer Rosewater is advocating legislation that will result in the repaving of Farnum-st. with asphalt.

Owatonna, Minn.—A petition has been presented to the council asking that Cedar-st., between Broadway and Rose, be paved.

Council Bluffs, Ia.—The council has ordered the paving of the approach to the patrol station on Bryan-st. with brick.

Racine, Wis.—Estimates have been submitted for paving Seventh-st. as follows: Brick, $8,537; cedar block, $6,459; macadam, $4,856.

St. Louis, Mo.—Ordinances have passed for reconstructing a number of streets with brick. Robt. E. McMath, prest. B. P. W.

Detroit, Mich.—The question of converting Lafayette-ave., from the city hall to Clack park, into a boulevard is being considered.

Allegheny, Pa.—The proposed river boulevard has revived the question of the projected boulevard from Osborne to Fair Oaks.

Durham, N. C.—The question of issuing $200,000 bonds for street improvements and $100,000 for a sewerage system will be voted on Jan. 7th.

Bay City, Mich.—A petition is being circulated asking that Center-st., between Midland and Ohio, be paved with asphalt block or brick.

Washington, D. C.—The district commissioners have authorized the paving of Flagler-place from U-st. northward, with asphalt block.

Minneapolis, Minn.—Plans for an alley through block No. 1, Pleasant Plain addition, have been accepted. L. A. Lydiard, cy. clk.

Saginaw, Mich.—Plans have been approved for improving the side and back streets of the city with macadam with tile drain on each side.

Youngstown, O.—Resolutions have been introduced providing for paving Himrod and W. Rayen-aves. and Market, S. Phelps and other streets.

Saginaw, Mich.—Resolutions have been passed to pave Washington-ave. with brick, and Perry-st. with cedar blocks. Alfred Davies, cy. clk.

Woonsocket, R. I.—An ordinance has been introduced providing for an appropriation of $50,000 for paving Main, Clinton and Social-sts.

Michigan, City, Ind.—Resolutions have been adopted for brick paving on Franklin, Michigan and W. Boston-sts., and objections will be heard Jan. 8th.

Sturgeon Bay, Wis.—Plans and specifications for paving and macadamizing the streets of the city have been accepted. Robt. H. Moth, engr., Kenosha.

Hamilton, O.—The city engineer has been directed to prepare plans and specifications for paving sixteen streets with asphalt, asphalt block or brick.

Scranton, Pa.—An ordinance has been introduced providing for brick paving on concrete on Providence road, from Court-st. to the Carbon-st. bridge.

Macon, Ga.—The residents on Walnut-st., between Spring and Orange, have petitioned for paving. Asphalt, brick or Belgian blocks will be considered.

Peoria, Ill.—Petitions have been presented to the board of local improvements asking that Randolph-ave., from North-st. to Chambers-ave. be paved with asphalt.

Baltimore, Md.—Ordinances have been introduced providing for brick paving in Brunt-st., from Gold to Baker, and macadam paving in Collins and Augusta-aves.

Lawrence, Kas.—A resolution has been adopted to curb and pave Warren-st., from Massachusetts to Mississippi, and Tennessee-st. with brick on concrete. Mayor Gould.

Albany, N. Y.—Ordinances have been passed to pave Broadway and Columbia sts. in front of the N. Y. C. & H. R. R. R. Station, next Spring. Walter Mellus, cy. engr.

Norwich, N. Y.—Petitions will be circulated asking that Broad-st. be paved with vitrified brick in the business portion and macadam in the residence portion.

St. Paul, Minn.—Plans and specifications have been prepared for paving Wabasha-st., from College to University-ave., with Kettle river sandstone on concrete.

Seattle, Wash.—The question of paving Madison-st. with brick on concrete, with cement sidewalks, is being considered; estimated cost, $35,600. R. H. Thompson, cy. engr.

Worcester, Mass.—Wright S. Prior, st. com'r, has recommended that means be devised for paving every street between Main and Summer-sts., from Front to Lincoln-square.

Oklahoma, O. T.—The city council ordered Dec. 11 that 25 blocks in the business districts be paved with brick The contract will be let in February. Geo. W. Spencer, cy. clk.

Des Moines, Ia.—A resolution has been adopted to improve University-ave. west of Thirty-fifth-st. The property-owners on Twelfth-st., from Forest-ave. to State-st., favor asphalt paving.

Utica, N. Y.—The county board of supervisors has passed a resolution asking the legislature to appropriate $500,000 for highway improvements under the Higbee-Armstrong law.

Essington, Pa.—The Corinthian Yacht Club has petitioned the court to close Front-st. and to open Second-st. If the petition is granted the club will macadamize Second-st.

Windsor, Ont.—A resolution was passed Dec. 11 authorizing a committee to circulate a petition among the property-owners

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in Sandwich-st. and Ouillette-ave., asking the city council to permit some other kind of paving than macadam to be laid on these streets.

Duluth, Minn.—A resolution was adopted Dec. 11, directing the city engineer to prepare estimates for over a mile of asphalt or asphalt block paving on Superior-st., from Eighth-ave. to Fifth-ave., east, and for asphalt from Fifth-ave. to Twenty-third-ave., east. The intersections will be of granite or brick.

New York City—Resolutions have been adopted for laying out a plaza at the southeast entrance of Prospect park, at the intersection of Ft. Hamilton and Ocean-aves.; grading and paving McKibben-st., from Bushwick-ave. to Bogart-st., with block; Osborn-st., from Blake to Livonia-ave., with asphalt; Hawthorne-st., from Flatbush-ave. to Rogers-ave., with asphalt.

San Francisco, Cal.—The board of public works on Dec. 7 directed Secretary Dark to advertise for bids for paving Grant-ave., from O'Farrell to Bush-sts., with asphalt on a basalt and cobble foundation. The supervisor's street committee decided Dec. 11 to recommend for passage an ordinance providing for the paving of Clay, Sacramento, Washington and Pine-sts., between Montgomery and Sansome, with bituminous rock or asphalt on a concrete base.

CONTRACTS TO BE LET.

Trappe, Pa.—Bids are asked until Jan. 19 for macadamizing the main street. D. M. Fulmer, chm. st. com.

Aitkin, Minn.—Bids will be received until Jan. 8 for corduroying about 280 rods of roads. J. S. Campbell, co. audt.

Audubon, Ia.—Bids are asked until Jan. 5 for road grading in Audubon county during 1901. A. F. Greenwalt, co. audt.

Cincinnati, O.—Sealed bids are asked until Jan. 7 for paving Dayton alley with brick. Geo. F. Holmes, clk. bd. pub. service.

Colusa, Cal.—Sealed bids are asked until Jan. 9 for constructing about 4⅛ mis. of the Arbuckle-Sulphur Creek road. Co. clk.

Anderson, Ind.—Bids are asked until Jan. 9 for building 21⅝ mis. of gravel roads in Stony Creek twp. J. W. Walker. chm. bd. co. commis.

Marion, Ind—Sealed bids are asked until Feb. 20 for macadamizing and asphalting "The Home Boulevard" in Center twp. Paris A. Hoover, chm. co. commis.

Cleveland, O.—Sealed bids are asked until Jan. 8 for brick paving, curbing, etc., on portions of a number of streets. John Vandevelde, deputy dir. pub. wks.

Rensselaer, Ind.—Sealed bids are asked until Jan. 8 for constructing the uncompleted portions of the DeMotte and Otis gravel roads. Wm. C. Babcock, co. audt.

Cedar Rapids, Ia.—Sealed bids are asked until Jan. 3 for paving Fifth-ave. and Division-st. with asphalt on concrete. R. A. Wallace, pub. imp. com. G. H. Meredith, cy. engr.

Toledo, O.—Sealed bids will be received until Jan. 2 for vitrified brick pavement in Barnet-ave., Twenty-seventh and Twenty-eighth, K. Bergman, Branders and Barbee-sts. B. P. W.

Cincinnati, O.—Sealed bids are asked until Jan. 16 for the reconstruction and repairs for the west approach of the Eighth-st. viaduct, including the reconstructing and repairing of sidewalks. Robt. Allison, prest. bd. pub. service.

Toledo, O.—Sealed bids are asked until Jan. 7 for paving Indiana-ave., from Ewing to Hawley-st., with brick, Kreodone creosoted block, asphalt or asphalt blocks, and George-st., from Cherry to Locust, with brick, asphalt or asphalt block. J. E. Connell, cy clk.

Cape May, N. J.—Sealed bids are asked until Jan. 9 for building 12.178 miles of good road from the intersection of the main seashore road with the Cape Island and Steamboat Landing Turnpike, Cape May City, to Crooked creek bridge, Cape May court house. Sealed bids are also asked until Jan. 9 for building 1.806 miles of good road on Asbury-ave., Ocean City, from Seventeenth-st. to Thirty-fourth-st. Henry S. Rutherford, dir. and chmn. road com. of bd. of chosen freeholders.

CONTRACTS AWARDED.

Birmingham, Ala.—The contract for paving Eleventh-st. with brick has been awarded to C. M. Burkhalter, for $31,323.

New Haven, Conn.—The contract for paving Chapel-st. from New York to State, with brick, has been awarded to the Abbott-Gamble Contracting company of New York City for $30,000.

Atlantic City, N. J.—The contract for paving Delaware, South Carolina and Mississippi-sts. has been awarded to the Delaware River Quarry and Construction company for $15,505.

Council Bluffs, Ia.—Bids were received Dec. 11 for asphalt paving on First-ave., Sixth, Seventh and Eighth-sts. The Barber Asphalt Paving company bid $2.28 and the Grant Paving company $2.31 a sq. yd.

North Stonington, Conn.—The contract for 13,025 feet of grading has been awarded to Michael A. Zuccardy of New London for $3,908. He also received the contract for constructing 3,200 feet of gravel road at 29 cents a lin ft.

Terre Haute, Ind.—Bids have been received for constructing the belt gravel roads in Otter Creek township as follow: T. W. Kinser & Sons, $11,973; Fitzpatrick Bros., $11,487; Keegan, Canald & McGuire, $10,600; Stone, Ross, Allen & Hull, $10,446; W. C. Dorsey, $9,966; Keegan & Phillips, $10,635; Thomas A. Scott, $11,797; M. Morrissey, $10,300.

Cleveland, O.—Bids were received for paving Marcelline-ave. with brick, as follows: Campbell Bros., $18,477; M. E. Kavanagh, $18,863; M. F. Bramley & Co., $19,331; Roehl Bros., $19,332; Northern Ohio Paving & Construction company, $19,469; Brennan & Buettner, $19,799; W. C. Gayer & Co., $19,963. For paving Union-st. with brick: Northern Ohio Paving & Construction company, $41,636; W. C. Gayer & Co., $43,356; M. F. Bramley & Co., $44,663; Brennan & Buettner, $45,286; Campbell Bros., $45,659. For paving Harvard-st. with brick: Campbell Bros., $29,662; Northern Ohio Paving & Construction company, $29,934; M. F. Bramley & Co., $30,313; W. C. Gayer & Co., $30,382; Brennan & Buettner, $31,546.

New Albany, Ind.—Bids were received Dec. 17 for paving two streets as follows: Barber Asphalt Paving company curb, 55 cents a lin. ft.; asphalt, 1½-in. surface, 2-in. binder, $2.05; 1-in. surface, 1½-in. binder, $1.92; excavation, 45 cents a cubic yd.;

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Western Paving & Supply company, curb, 56 cents; asphalt, 1½-in. surface, 2-in. binder, $2.24; exc., 50 cents. William O. Sweeney of Jeffersonville, curb, 49 cents; brick, $15.94 per square; Mack block, $18.75 per square. D. Harmon of New Albany, curb, 42 cents; brick, $16.95; Mack block, $22.65.

Cincinnati, O.—Bids were submitted Dec. 18 for improving Reading Road in two sections, one involving 21,200 square yards of granite paving and one involving 4,670 square yards of brick paving as follows: M. Heffron, granite, $2.88; L. F. Foltz, granite, $3.07; brick, $1.23; William Fogarty, granite, $2.85; brick, $1.12; J. J. Smith, granite, $2.95; brick, $1.10; Henkel & Sullivan, granite, $3.00; brick, $1.20; H. Drekman, granite, $3.05; brick, $1.05; Van Sandt & Meack, granite, $3.05; brick, $1.19; Foltz & Jonte, granite, $3.00; F. H. Kirchner & Co., granite, $2.85; brick $1.32; William Flynn, granite, $3.22; brick, $1.23; G. P. Walker, granite, $3.00; brick, $1.25; J. A. Eberhardt, granite, $2.65; brick, $1.15; Evan Evans, brick, $1.03; Louis Drach, brick, $1.20; David Walker, brick, $1.20.

SEWERS.

Petaluma, Cal., (special)—N. S. Frost, city engr., says that 875 feet of 6-in. pipe sewers have been completed.

Norwood, O.—The state board of health has been requested by this village to take steps to abate the nuisance caused by the disposal of the sewage in the Ross Run creek.

Louisville, Ky.—Suits have been entered against this city by John Driscoll, John G. Harmony, Thos. M. Higgins and Clements Kiel for $3,000 damages each. The plaintiffs claim that by gross negligence on the part of this city emptying sewers into the Bear Grass creek their residences in Barrett-ave. near Beargrass creek have become uninhabitable.

Columbus, O.—An opinion has been handed to Secretary Probst of the board of health by Attorney-General Sheets, stating that plans for a sewerage system authorized by a special act of the legislature must first have the approval of the board of health. C. O. Probst, secretary of the state board of health, and a committee of that board are visiting eastern cities preparatory to passing upon the sewage disposal proposition of that city.

CONTEMPLATED WORK.

Peshtigo, Wis.—A sewerage system is contemplated.

Warsaw, N. Y.—Plans are being prepared for a sewerage system.

New Brunswick, N. Y.—Sewers will be constructed in several streets.

East Hampton, N. Y.—Plans are being prepared for a sewerage system.

Fredericksburg, Va.—Bids will be advertised for a general sewerage system.

Cedar Rapids, Ia.—An ordinance for storm water sewers was passed Dec. 11.

Hanford, Cal.—Bids are desired Jan. 14 for $50,000 sewerage bonds, B. W. Moore, cy. clk.

Marshall, Mich.—A petition was submitted to the council Dec. 13 for a lateral sewer.

Jeannette, Pa.—Bids are wanted until Feb. 1 for $120,000 sewer and street improvement bonds.

West Palm Beach, Fla.—This town voted Dec. 15 to issue bonds for a sewerage system.

Rockford, Ill.—The city engineer has been directed to prepare plans for a sewerage system.

Irwine, Pa.—The question of issuing bonds for a sewerage system will be voted on Feb. 19.

Belleville, Ill.—The city clerk has been directed to advertise for bids for a sewer on W. Main-st.

New York City—A resolution has been passed to construct a sewer from East river to William-st.

Everson, Pa.—A company has been organized to put in a new sewerage system, William Hay, pres't.

Fort Sam Houston, Tex.—The war department will expend $25,000 to $30,000 for a sewerage system.

Grand Rapids, Mich.—The use of the bed of the old canal as a location for a trunk sewer is proposed.

Tonowanda, N. Y.—The question of creating a trunk sewer out of the State ditch is being discussed.

Danville, Ky.—Bids are asked until Jan. 10 for $25,000 bonds for a sewerage system. J. B. Fisher, mayor.

Akron, O.—The city engineer has been authorized to prepare maps or plats for the proposed main trunk sewer.

Haddonfield, N. J.—Plans for a sewerage system will be made by Alexander Potter. C. E., New York City.

Rochester, N. Y.—The construction of sewers on Curtis and Crouch-sts. is proposed. T. D. Pulver, cy. clk.

Bessemer, Ala.—A bill has been passed by the house authorizing this city to issue bonds for constructing sewers.

Omaha, Neb.—Andrew Rosewater, cy. engr., has suggested a bacterial system of sewerage for the Saddle Creek district.

Washington, Pa.—(Special.)—Samuel Amspoker, cy. atty., says the question of sewerage is being agitated by the local press.

Webb City, Mo.—Bids will be received soon for about 5 mls. of sewers in Vine and Church-sts. J. W. Kieff, cy. clk.

Kansas City, Mo.—Preliminary surveys are being made for the continuation of the O. K. creek sewer to the Missouri river.

Wauwatosa, Wis.—Plans for a sewerage disposal system and purification plant are being made by Alvord & Shields of Chicago.

Baltimore, Md.—Mayor Hayes will ask the legislature to pass an enabling act authorizing a loan for a complete sewerage system.

Milwaukee, Wis.—A bond ordinance for $50,000 for the third section of Kinnickinnic river flushing tunnel is proposed.

Hamilton, O.—Plans and specifications for storm and sanitary sewers in certain streets were submitted by City Engineer Dillon Dec. 4.

Perry, N. Y.—Plans for a sewerage system have been approved, which will include 15 mls. of cast iron, brick and vitrified pipes, man-holes, etc.

Ft. Thomas, Ky.—A survey for a new sewer from Ft. Thomas to the river has been made by City Engineer Morton and

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Superintendent Hornung of the water works.

Hoboken, N. J.—Plans for a sewerage system for the meadow district and for the general improvement of the existing system have been prepared by Thos. McCann, cy. engr.

Centralia, Ill.—The sewer committee has been authorized to get options on the right-of-way and 5 acres of land outside the city limits for the outlet and filter beds for the proposed sewerage system.

Laurel, Miss.—(Special.—Plans for sewage disposal by intermittent sand filtration have been made by the Iowa Engineering company of Iowa City, Ia., for the Laurel Cotton Mills, and it will be constructed at once.

Madison, Wis.—The common council voted Dec. 3 to abandon the sewage disposal works, and on Dec. 14 adopted the septic tank sewage disposal system, and directed City Engineer Turneaure to prepare plans and ask for bids to be opened Dec. 27.

Mamaroneck, N. Y.—The village trustees have appointed a board of sewer commissioners consisting of Dr. John F. Hunter, Theodora Van Amringe and John W. Goodwin to inquire into plans for a sewerage system. The plans were made by John F. Fairchild of Mt. Vernon.

Toronto, Ont.—A comparison of the cost of separate and combined systems of sewers for the Indian road district show a cost of $15,438 and $31,185, respectively, including estimates for pumping and disposal plants at $5,000 and $7,350, respectively. Additional sewers for the combined system would cost 25 per cent. more than the separate system.

Erie, Pa.—The estimated cost of arching Mill Creek, from the P. & E. R. R. culvert to Twenty-sixth-st., is $416,000; for an iron pipe in the creek channel, with lateral sewer connections, $150,000; for two lateral sewers parallel with the creek, on east and west sides of same, intercepting the sewers now discharging into the creek $68,000; for a V-shaped channel in the bed of the creek, 6-ft. across the top and 4-ft. deep, $16,000.

CONTRACTS TO BE LET.

Mishawaka, Ind.—Bids were asked until Jan. 7 for a sewer in Sixth-st. H. C. Eggleston, cy. clk.

Birmingham, N. Y.—New bids will be received until Jan. 13 for the Conklin-ave. sewer. S. D. Kane, cy. clk.

Toledo, O.—Sealed bids are asked until Jan. 7 for cylindrical brick sewers in certain streets. John E. Connell, cy. clk.

Boston, Mass.—Sealed bids will be received until Jan. 12 for a pumping plant for the Metropolitan Sewerage commission. James A. Bailey, chmn.

Washington, D. C.—Sealed bids are asked until Jan. 10 for a sewerage and water works system for Jacarilla agency, N. Mex. W. A. Jones, commissioners Indian affairs, Washington, D. C.

St. Petersburg, Russia—Competitive plans for a sewerage system for this city will be received until Aug. 21. Prizes of $6,480, $4,100 and $2,100 will be awarded for the best three plans. Municipal comrs.

New York City—Bids are asked until Jan. 2 for sewers in portions of a number of streets in Manhattan; sewer in Van Alst-ave., Queens; furnishing, delivering, housing and trimming 5,000 bbls. of No. 1 Maine Rock lime at the sewage disposal works in the 26th and 31st wards, Brooklyn. Joseph Kane, comr. sewers.

Chicago, Ill.—Sealed bids are asked until Feb. 20 for excavating solid rock from the south fork of the south branch of the Chicago river near Thirty-fifth-st. and for excavating through the spoil bank of the sanitary district on the north side of the main channel at the east end of section K. Alex. J. Jones, prest. bd. sanitary trustees.

CONTRACTS AWARDED.

Little Rock, Ark.—The contract for a sewer in District No. 27 was awarded to Nick Peay for $5,200.

Northampton, Mass.—The contract for extending the Orchard-st. sewer was awarded to W. H. Riley & Co. for $300.

San Francisco, Cal.—The contract for the Andover-ave. sewer was awarded to the City Street Improvement company for $8,093.

Marietta, O.—Bids for building a sewer in the third district have been received, as follows: John Wilking, $3,836; Adam Bros., $3,172.

Denver, Col.—The J. M. O'Rourke Construction company was awarded the contract, Dec. 14, for building the north side sewer, No. 4, for $8,903.10.

Jenkintown, Pa.—The P. & R. railroad company has awarded a contract to Armstrong & Printzenhoff of Philadelphia for constructing a drainage system.

Buffalo, N. Y.—Sewer contracts were awarded, Dec. 13, as follows: Norwalk-ave., Thos. Dark & Co., $2.115; E. Parade-ave., W. G. Smith, $2,389.

Baton Rouge, La.—The contract for the sewerage system, which was abandoned by L W. Brown of New Orleans, has been awarded to Guild & Co. of Chattanooga, Tenn.

New York City—The bids submitted by Leeson & Dougherty, 215 W. One Hundred and Twenty-fifth-st. Dec. 19 for sewers in portions of Kingsbridge road, Terrace View-ave. and Kingsbridge-ave., $12,191, was recommended for award.

Warsaw, Ind.—The contract for construction of sewers was awarded Dec. 18 to E. Woods, of Decatur, Ind., for $18,979.43. Bids were received from eight firms, ranging from the above price to $34,254.35.

Waterford, N. Y.—Bids were received Dec. 17 for sewers on the North Side as follows: William Stanton, Cohoes, without mason work, $15,094; with mason work, $15,505; John B. Doyle, Cohoes, without mason work, $13,649; with mason work, $13,664; Baker & Judson, Gloversville, without mason work, $16,845; with mason work, $17,345.

Suffolk, Va.—Bids were received Dec. 10 for sewer work including terra cotta and cast iron pipe, manholes, flushtanks, lampholes, etc., as follows: Hite-Smith & Minshall of Norfolk, Va., engrs.: Frank Pidgeon, New York City, $12,038; Richardson & Redman, Newport News, Va., $8,581; A. M. Thomas, Lock Haven, Pa., $7,968; M. F. McMarara Co., Washington, D. C., $7,141; A. L. Patterson & Co., Macon Ga., $6,856; Noonan & Pierce, Newport News, Va., $8,029; A. E. Wilson, Salisbury, N. C., $8,490; Rosser & Castoe, Bellaire, O., $7,498; Guild & Co., Chattanooga, Tenn., $5,930.

Philadelphia, Pa.—Bids were received

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Dec. 18 for constructing a relief to the Cohocksink sewer along Shackamaxon-st. from Delaware river to Thompson-st., and east on Thompson-st., to Mascher-st. A contract for this sewer was awarded about five months ago to B. J. Sullivan for $100,000. The contractor had begun the work of construction when he took exception to the bureau of survey insisting upon additional masonry work being performed when the same was not provided for in the specifications, and refused to proceed with the work. The contract was annulled and revised.

WATER-WORKS.

Municipal water works systems are favored at Kankakee, Ill., and Macon, Ga.

Dallas, Tex.—Chester B. Davis, C. E., Chicago, Ill., says that the water pipes are being destroyed by electrolysis.

Santa Rosa, Cal.—Preliminary steps have been taken against the city for damages by the McDonald Water company, because the city constructed a municipal water system.

Los Angeles, Cal.—Suit was filed in the superior court Dec. 15 by Spencer H. Smith, attacking the validity of the $2,000,000 bonds issued by this city to acquire municipal ownership of the city water supply.

Johnstown, Pa.—The Johnstown Water company has purchased nearly two sq-miles of the 5.5 sq. miles of the drainage area of Mill Creek above the company's reservoir. This is done for the protection of the water supply.

St. Louis, Mo.—The board of public improvements adopted the adverse report of the water committee and rejected the proposition of a syndicate of eastern capitalists to supply this city with water derived from the Meramec Springs and rivers.

CONTEMPLATED WORK.

Westfield, N. Y.—The water supply is inadequate.

Houghton, Mich.—The council voted to buy fifty water meters.

Devils Lake, N. D.—A system of water works is urged.

Canton, O.—The meter system will be established.

Austin, Tex.—The purchase of additional engines is proposed.

Shenandoah, Pa.—The improvement of the water works is contemplated.

Chillicothe, Mo.—The water supply is to be increased and improved.

Grinnell, Ia.—Bids will be asked soon for a water works system.

Allegheny, Pa.—The purchase of one new pump and several boilers is proposed.

Pittsburg, Pa.—The water purification plant will be constructed at once.

Manito, Ill.—Plans and specifications for a water works system are being made.

Harrisburg, Pa.—The question of securing a new water supply is being considered.

Hammonton, N. J.—The installation of a water works and gas plant is proposed.

St. Augustine, Fla.—Plans are being discussed for increasing the city water supply.

Washington, D. C.—The board of trade favors filtration of the water supply to prevent disease.

Lockport, N. Y.—The city is considering a proposition for a pure water supply.

The question of issuing bonds for water works will be voted on as follows: Tamaqua, Pa.; Glen Rock, Pa.

San Francisco, Cal.—The question of acquiring a municipal water system will be voted on Feb. 1.

Passaic, N. J.—The Dundee Water company has been organized to build water works. Francis McGuire, prest.

Henderson, Ky.—The board of water works commissioners has been authorized to put in a filter plant.

Berwick, Me.—W. S. Matthews and W. D. Clark are a committee to arrange with Somersworth, N. H., for a water supply.

Ottumwa, Ia.—Plans for the new municipal water works system are being made by Hiram Phillips, C. E. of St. Louis, Mo.

Joliet, Ill.—An ordinance is being prepared which provides for a reservoir with mains equipped with electric valves.

Portsmouth, O.—The property-owners of Earlytown have petitioned for the extension of water mains to that suburb.

Muscatine, Ia.—(Special.)—The Muscatine water works has been sold to the city and will be operated under municipal ownership.

Medway, Mass.—A commission has been elected to investigate sources for increased water supply. D. W. Simon, chmn. water board.

Philadelphia, Pa.—Plans are being prepared for the proposed filter plants at Roxborough, Belmont, Queen Lane and Forrestdale.

Ft. Lincoln, N. D.—The plans for the proposed water works system will be revised to permit the introduction of the lift system.

The extension of water mains is contemplated at the following cities and towns: Kansas City, Mo.; Grand Forks, N. D.; Bayonne, N. J.; Geneva, Ill.

Geneva, O.—(Special.)—Plans for a water works system are being prepared by the Rice Engineering company of Cleveland, O. O. B. F. Hewit, vil. engr.

Chicopee, Mass.—Plans have been prepared by the water commissioners for building water works and furnishing a new water supply for the Seventh ward.

The extension of water works systems is contemplated at the following places: Belle Plaine, Minn.; Van Buren, Me.; Baldwin, Kas.; Galt, Mo.; Cedar City, Utah.

Aurora, Ill.—John J. Hainesworth, C. E., Indianapolis, Ind., has made a proposition relative to the establishment of a water works system in this town.

Kansas City, Mo.—The board of public works decided Dec. 3 to appropriate $2,000 for the employment of two engineers to investigate the water works and suggest needed improvements.

The question of issuing water bonds has been favorably voted on at the following places: Mellette, S. D.; Spearfish, S. D.; Wickcliffe, Ky.; Lake Park, Ia.; Pembroke, Ont.

Laurel, Mass.—(Special).—Material will be purchased for constructing the water works system, the contract for which has been awarded to local parties.—Iowa Engineering company, engineers.

La Salle, Ill.—An ordinance has been passed providing for the enlargement and extension of the water works system, including larger and additional water mains, additional wells, standpipe, etc. A. C. Finkler, cy. clk.

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CONTRACTS TO BE LET.

Abingdon, Ill.—Bids are desired until Jan. 5 for sinking an artesian well. Jos. Richey, mayor.

Sisseton, S. D.—The contract for building water works will be let Jan. 3. Paul Babcock, town clk.

Grand Rapids, Mich.—Sealed bids are asked until Feb. 15 for furnishing the city with a permanent pure water supply. Will J. Sproat, clk. B. P. W.

Dallas, Tex.—Bids are asked until Jan. 10 for work in connection with the improvement of the water works. B. E. Cabell, mayor; Hugh Raines, cy. engr.

Washington, D. C.—Sealed bids are asked until Jan. 10 for a water and sewer system at Jicarilla Agency, N. Mex. W. A. Jones, com'r Indian Affairs, Washington, D. C.

Louisville, Ky.—Sealed bids are asked until Jan. 27 for the construction of a system of American (mechanical) filters. The work is subdivided into 24 different parts. Chas. R. Long, prest. Louisville Water company.

New York City.—Bids are asked until Jan. 17 for constructing two vertical triple-expansion 15,000,000-gallon pumping engines, boilers and appurtenances for the high-service works at the new aqueduce. Wm. Dalton, com. water sup.

Cincinnati, O.—Sealed bids are asked until Jan. 15 for the construction and erection of the extension of the steel shell of the pump pit shafts for the Eastern pumping station, and for the manufacture, furnishing and delivering of water valves, sluice gates and mud valves for the settling reservoirs from the Eastern pumping station. Aug. Herrmann, prest. bd. trustees, W. W. com's.

CONTRACTS AWARDED.

New Haven, Conn.—The contract for constructing the Saltonstall water tunnel was awarded to F. R. Draw & Co. of Pittsburg, Pa., for $26,000.

West Plains, Mo.—The contract for constructing water works and an electric light plant was awarded Dec. 4 to the Southern Engineering company, of St. Louis, for $24,834.

Providence, R. I.—Bids were received Dec. 13 for furnishing cast iron water pipe, as follows: Camden Iron Works company, Philadelphia, at $24.71, total $13,255, time 50 days; Warren Foundry and Machine company, N. Y. City, at $24.30, total $13,035, time 30 days (awarded); N. S. Cast Iron Pipe and Foundry company, Philadelphia, at $25.80 for 4-in. pipe and $24.90 for 6 and 8-in. pipe, total $13,365, time 45 days.

BRIDGES.

Dubuque, Ia.—City Engr. Blake has made surveys for a viaduct at Fourth-st.

Pine Bluff, Ark.—The city is considering plans for a bridge across the Arkansas.

Davenport, Ia.—The people of Green have signed a petition asking for a new bridge.

Duluth, Minn.—A bridge costing $100,000 is contemplated across the Duluth Ship canal.

Scranton, La.—The county board of supervisors authorized a steel bridge over Big creek.

Arlington, Wash.—The county commissioners will erect eight or nine new bridges 25 to 40-ft. span.

Bridgeport, Conn.—Bids will be called for in the spring for a new bridge across Yellow Mill pond.

Aledo, Ill.—The Illinois Bridge and Iron company of Sullivan has the contract for a 210-ft. bridge at $2,199.

Battle Creek, Mich.—This city is asking for authority to bond itself for $25,000 for rebuilding its bridges.

Castlewood, S. D.—Bids are wanted Jan. 3 for 60-ft. steel bridge across Big Sioux river. O. E. Anderson, co. audt.

Urbana, Ill.—The Arthur Bridge company of Arthur has received a contract for a 64-ft. bridge in Newcomb twp. for $1,125.

Watertown, N. Y.—The new Arsenal-ave. bridge over the N. Y. Central railroad will cost $28,000. C. O. McComb, cy. engr.

Fargo, N. D.—Bids are wanted Jan. 8 for steel bridge across Maple river in Durbin twp. 120-ft. span. O. J. Olson, co. audt.

Syracuse, N. Y.—The citizens of the north side are petitioning the council for a bridge over the Oswego canal at Butternut-st.

Townsend, Mont.—A bridge across the Missouri is to be built costing $9,895. C. E. H. Campbell, Council Bluffs, Ia., cont. engr.

Dillon, Mont.—It is reported that the county commissioners will receive bids in March for a 100-ft. bridge over the Big Hole river.

Sullivan, Ind.—The county commissioners will receive bids Jan. 11 for steel, wrought iron and wooden bridges. J. M. Lang, co. audt.

Chehalis, Wash.—It is reported that the county commissioners will receive bids Jan. 8 for 140-foot span across Chehalis river.

Charlevoix, Mich.—The election in favor of a new bridge carried by a vote of 207 to 62. The contract will be let by the township board.

East Long Meadow, Mass.—A steel bridge costing $22,000 will be required at the Robeson crossing, if the grades are to be separated.

Tillman, Ore.—The county commissioners will receive bids in January for an 80-foot span bridge across Beaver creek, Homer Mason, co. clk.

Washington, D. C. —The National Memorial Bridge Association is considering methods of convincing congress of the necessity of the bridge.

Ponca, Neb.—Bids will be received Jan. 9 for all steel bridges that may be specified in Dixon county for 1901. J. F. Ekerck, co. clk.

Wilber, Neb.—Bids will be recieved Jan. 8 for all wooden bridges that may be specified in Saline county for 1901. J. W. Shestak, co. clk.

Wilmington, Del.—The city will build the approaches and the B. & O. railroad company will build the bridge over the company's tracks at Sixth-st.

Syracuse, N. Y.—The city engineer is preparing estimates of the cost of a new bridge over the Oswego canal at North Salina-st. and Belden-ave.

Weatherford, Tex.—William Flynn has received the contract from the commissioners' court for three new bridges in Parker county, costing $3,300.

Gas City, Ind.—The Indiana Bridge company of Muncie has beeen awarded the contract for the new bridge betweeen Gas City and Jonesboro, at $20,000.

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Topeka, Kas.—The legislature will petitioned for authority to vote bonds for a bridge over the Kansas river, between Menoken and Missouri townships.

Seabright, N. J.—Contract for steel drawbridge over South Shrewsbury river has been let to the American Bridge company for $64,697. The highest bid submitted was $64,980.

Atlanta, Ga.—The application of the Atlanta Rapid Transit company for the right to cross the railroad track on Peter-st. at grade has started the agitation for a viaduct.

Duquesne, Pa.—The Pennsylvania Bridge company, Beaver Falls, has received the contract for a steel viaduct over Patterson Hollow on the line of Fifth-st. for $13,146.

Colfax, Wash.—Bids will be received Jan. 8 for a combination bridge, 90-ft. span with 18-ft. driveway, over Pine creek, near Tekoa. John Corner, co. audt.

Lansing, Mich.—Preliminary estimates for the purpose of voting an issue of bonds for a bridge at Washington-ave. south have been made by City Engineer H. A. Collar.

Milwaukee, Wis.—The board of supervisors has passed a resolution authorizing an issue of $275,000 of bonds for a viaduct across Menominee Valley at the upper end of Grand-ave.

Kansas City, Mo.—A bridge at Benton boulevard is under consideration by H. U. Mudge, president of the Belt Railway company, and George E. Kessler, engineer of the park board.

East Liverpool, O.—A bridge from this city to Chester, W. Va., costing about $250,000, will be built by local and Pittsburg capitalists if the government grants permission.

Brooklyn, N. Y.—The Board of Public Improvements has given permission to Bridge Comr. Shea to build bridges over the Gowanus canal at Hamilton-ave. for $100,000, and at Ninth-st. for $70,000.

Corning, Ia.—Contracts will probably be let on Jan. 8 for the metal work of one bridge of 62-ft. span and three bridges of 47-ft. span, each over Nodaway river. S. M. Kirkpatrick, chrmn. bd. suprs.

Chippewa Falls, Wis.—New bids have been asked for the bridge across the Chippewa river by the city council. It will cost about $40,000. Wm. Bowe, chrm. com.; T. J. Cunningham, mayor; O. L. Nyhus, cy. engr.

Atlantic City, N. J.—Separate bids will be received Jan. 2 for substructure and superstructure of a 335-ft. highway drawbridge at Albany-ave. M. L. Jackson, chrmn. bridge com.; J. J. Albertson, engr.

Cleveland, O.—The engineer's estimate for the superstructure of the Middle Seneca-st. bridge is said to have been $34,000. The lowest bid received Dec. 12 was from C. V. Strobel, Chicago, Ill., $56,195.

Pittsburg, Pa.—The committee on bridges recommended the acceptance of the contract for the new S. Tenth-st. bridge 40 feet wide, as awarded by Geo. W. Wilson of the Department of Public Works. Cost will be $265,000.

Kansas City, Mo.—The board of public works has approved plans for a viaduct on Summit-st. over the Belt line. The Metropolitan street railway has agreed to build the viaduct provided the city will maintain it.

Reading, Pa.—The Reading Bridge and Warehouse company has been incorporated to build a toll bridge across the Schuylkill from Sixth and Willow sts. to Oakland-ave. John H. Deery, Philadelphia, and William A. Witman, Reading.

Cincinnati, O.—Bids will be received by the Board of Public Service at 12 o'clock Jan. 16 for reconstruction and repair of superstructure and approaches of the Liberty-st. viaduct, 2,208 ft. long. Robt. Allison, pres.; Geo. F. Holmes, clk.

Benwood, W. Va.—Bids will probably be wanted Jan. 20 by the Bellaire, Benwood & Wheeling Bridge company for an iron bridge about 1,200 ft. long over the Ohio river, between Bellaire and Benwood. J. M. Grady, prest., Braddock, Pa.

Columbus, O.—Sealed proposals will be received at the county auditor's office, Columbus, until noon Jan. 3 for reflooring the roadways and sidewalks of the Rich-st. bridge, the work to be done in the spring. 98,000 ft. b. m. of oak will be necessary.

St. Joseph, Mich.—Estimates are being made for a 400-ft. steel viaduct, with 30-ft. roadway and two 6-ft. walks, to carry a 20-ton street car, across Michigan-st. valley, for the purpose of voting for a bond issue. C. S. Rigby, cy. engr.

Portland, Me.—Mayor Robinson has received official notice from the secretary of war requiring the widening of the draw of Vaughan-st. bridge, between Portland and South Portland. This will necessitate a new bridge 1,314 ft. long, costing $213,000, in steel.

Clarion, Pa.—The Phoenix Bridge company, of Phoenixville, was awarded the contract for a state bridge over the Clarion river for $35,000 by the State Board of Public Grounds and Buildings. Herman Loub of Pittsburg was elected supt. of construction.

Allentown, Pa.—The bridge at Union, from Eighth-st. to Salisbury, across Little Lehigh river, will be built by the Allentown and South Allentown Bridge company, 1,750-ft. span with about 2,200-ft. approach. Est. cost, $200,000. Bids will soon be wanted. Fred E. Lewis, prest.; R. S. Rathbun, chf. engr.

Peshtigo, Wis.—The town meeting held Dec. 7 voted by 56 to 1 in favor of the new steel bridge across the Peshtigo river to cost $8,500, half to be paid by the county and half by the town. The committee of the county board to act with the town board will probably be appointed Jan. 2, 1901.

Milwaukee, Wis.—Howard Russell, C. L. Linde, W. H. Schuchardt, C. F. Wringer, William Kozick, Peter Brust, Cecil Chapman and Charlton, Gilber and De Mar submitted competitive plans for the Grand River-ave. bridge to the Architectural club. The plans will be referred to the board of public works for definite action.

Cincinnati, O.—Bids will be received by the Board of Public Service until 12 o'clock, Jan. 16, for superstructure in connection with reconstruction of west approach for Eighth-st. viaduct; two plate girder spans 70 ft. each, one of 60 ft.; asphalt roadway 36 ft. wide and two cement sidewalks each 6 ft. wide. Robert Allison, president; George F. Holmes, clk.

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Atlanta, Ga.—Grant Wilkins received the contract for building the Whitehall-st. viaduct for $39,000. Five other bids were received, the highest being $46,899.40. These are the prices to be paid by the city. Mr. Wilkins's total bid was $54,800, but $15,000 of this amount is to be paid by the railroads. The contract must be approved by the chief engineer of the N. C. & St. L. railroad.

Boston, Mass.—City Engineer Jackson will soon advertise for bids for masonry and retaining walls for approaches to bridge over the tracks of the Terminal Co. and the channel between Atlantic-ave. and South Boston. The approaches will be 600 ft. long from Atlantic-ave. and 500 ft. from South Boston. The roadway will be 50 ft. wide and the draw will be 200 ft. long.

Philadelphia, Pa.—The city council, on Dec. 6, passed a bill authorizing bridges built at the following places:

Thirty-third-st., over Connecting railway and Reading railway, $125,000.

Frankford creek, on line of Frankford-ave. and on line of Old Front-st., including change in course of the creek, $100,000.

Allegheny-ave., under the North Pennsylvania railroad, $40,000; city's share, half of the cost.

Luzerne-st., under North Pennsylvania railroad, to abolish Rising Sun Lane crossing, $91,000.

Lehigh-ave., under the Connecting railroad, $74,000.

Gibson-ave., over the Baltimore & Philadelphia railroad, $30,000; cost divided between city and railroad.

Fifty-seventh-st., over West Chester & Philadelphia railroad, $28,000.

Seventy-first-st., over Philadelphia, Wilmington & Baltimore railroad, $17,000.

Oak Lane, over North Pennsylvania railroad, $10,000; city's share, half.

High-st., Chew-st. and Washington-lane, under the Chestnut Hill railroad, $70,000.

Olney-ave., under the Tabor branch of the Philadelphia & Reading railway and the North Pennsylvania railroad, $50,000; city's share, half.

Dauphin-st., under the Connecting railway, $40,000.

Passyunk-ave., across the Schuylkill, $75,000 to begin the work.

STREET LIGHTING.

Gretna, Neb.—A municipal electric light plant is contemplated.

O'Neill, Neb.—The establishment of an electric light plant is contemplated.

Independence, Kas.—The question of lighting the streets is being agitated.

LaCrosse, Wis.—The question of municipal lighting is again being considered.

Johnstown, N. Y.—The organization of a new electric light company is contemplated.

New Sharon, Ia.—The electric lighting plant is to be improved and a heating system installed.

Chickasha, I. T.—The Chickasha Water and Electric Light company will put in a plant in this town.

Story City, Ia.—An electric light company has been formed and a plant will be constructed at once.

Glenville, O.—A committee has been appointed to investigate the question of electric lighting.

Nashville, Tenn.—This city voted to issue $150,000 for installing an electric light plant. J. M. Head, mayor.

Jamestown, N. D.—An ordinance will be prepared and submitted to all parties who desire to build an electric light plant.

Clyde, N. Y.—The contract for lighting the streets with electricity for five years was awarded to Charles A. Lux of this city.

Weiser, Idaho—The town council contemplates the establishment of an electric light plant. A. B. Anderson, mayor; D. A. Ucler, cy, engr.

Jackson, Tenn.—A committee has been appointed to investigate the advisability of the city owning and operating its own lighting plant.

Saginaw, Mich.—The Bartlett Illuminating company is replacing the direct circuit system of lighting with the latest improved alternating system.

Stella, Neb.—A stock company has been organized among the local business men for the purpose of establishing an electric light plant.

Fort Sheridan, Ill.—The contract for making plans and specifications for an electric light plant was awarded to A. G. McPherson of Highland Park.

Portsmouth, N. H.—The city council made a ten-year contract Dec. 13th with the Portsmouth Gas, Electric Light and Power company to light the streets.

Richmond, Ind.—Sealed bids are asked until Jan. 4th for installing an electric light plant. Jas. B. Nelson, engr., Indianapolis, Ind. Thos. R. Jesup, cy. atty.

Little Falls, N. Y.—J. W. Lovenheim has been granted a franchise for establishing an electric light plant at a price not to exceed 65 cents per lamp of 16-candle power.

Cape May, N. J.—The city council voted Dec. 4th to abandon electricity for public lighting and go back to gas. The citizens are indignant with the councilmen who voted for the contract.

Chicago, Ill.—Mayor Harrison has appointed John V. Farwell, jr., F. H. Cooper, Addison Blakley and Chas. H. Holmes members of the municipal gas commission to confer on special state legislation.

Albany, N. Y.—A resolution proposed by Alderman Leddy provides for the sale of a franchise for electric lighting to any person, company or organization presenting the highest bid at a public auction.

Indianapolis, Ind.—The Sun-Vapor Street Lighting company, Dayton, O., secured the contract for furnishing the city with 200 or more vapor lights at $16.50 per lamp per year, and 25 or more Welsbach lamps at $30 each per year.

Newton, N. J.—The United Gas Improvement company has been awarded the contract for rebuilding the gas works in this city. The present Van Syckle water gas process will be replaced by a modern double superheater, Lowe water gas system.

Somerville, Mass.—A new five-year contract has been awarded to the Somerville Electric Light company, and new machinery will be installed and all the open arc lamps now in use will be replaced with alternating and enclosed arc lamps.

Napolean, O., (special)—The contract for wiring and furnishing fixtures complete for

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the lighting of the Henry county court house with 215 incandescent lights has been awarded to Meekison & Magill for $1,650.

West Pittston, Pa.—Bids will be received until Jan. 7 for furnishing five 2,000-c. p. arc lights and 125 25 and 32 c. p. incandescent lights, or for any other modern means of street lighting, for 2. 3 or 5 years. T. W. Jenkins, prest.

Springfield, Mass.—The common council has authorized the mayor to complain to the state gas and electric light commissioners that the price charged by the United Electric Light company is excessive, and asking that a reduction be made as the board may deem proper.

South Boston, Va.—Bids are asked until Jan. 31 for the equipment of the electric light plant being built, as follows: One 400 H. P. dynamo, one 300 H. P. motor, two 150 kilowatt, 2,200 volt two-phase generators, one 150 kilowatt, 2,200 volt two-phase generator. J. A. Mebane, engineer.

Menominee, Wis.—The mayor and city clerk have been authorized to make a contract with the Monominee Electric Street railway and Power company to furnish lights for the city during 1901 at $62 each per annum for 58 1,200 c. p. arc lights, and $15 each for 50 32 c. p. incandescent lamps. The contract was to be submitted to the council Dec. 31.

Painesville, O.—The council is considering a proposition by B. P. Foster of Cleveland to buy the Painesville electric light plant and to operate a gas plant. He proposes to purchase the village lighting plant at its appraised value if given ten-year contract for lighting the village, and will charge $60 per annum. In connection he asked for a 25-yr. franchise for installing a plant to furnish 30 c. p. gas for fuel and power purposes at 90 cents per 1,000 ft. net.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Jackson, Mich.—The question of garbage disposal by cremation is being investigated.

Coshocton, O.—Bids will be invited for sweeping the streets by the contract system.

Aurora, Ill.—A resolution has been adopted to purchase six steel asphalt paving cleaners.

Jersey City, N. J.—The contract for street cleaning for a year has been awarded to Henry Byrne.

Lawrence, Mass.—Mayor Leonard is investigating the question of establishing a new garbage disposal plant.

Indianapolis, Ind.—The contract for street sweeping during 1901 was awarded to Chas. H. Stuckmeyer at 18¼ cts. per 10,000 sq. ft.

Dallas, Tex.—The city secretary will be instructed to advertise for a 100-yard crematory, each bidder to furnish plans and specifications.

Chicago, Ill.—The contract for the erection of a garbage crematory cell at the electric lighting station at Chicago-ave. and Sedgwick-st. was awarded Dec. 7 to the Wright Crematory company for $1,650.

St. Louis, Mo.—The board of public improvements contemplates amending the municipal code so that the street cleaning, which is now done under contract, may be placed in the hands of the street commissioner.

Philadelphia, Pa.—The contract for cleaning streets was awarded to the American Contracting & Manufacturing company as follows: Cleaning streets, $549,584; cleaning alleys and undedicated streets, $46,000. This company also received the contract for collecting and disposing of the city's garbage for one year for $338,800.

PARKS.

Chicago, Ill.—Douglas boulevard is to have a fountain, at an estimated cost of $10,000 to $15,000.

Bridgeport, Conn.—A plan is being considered which provides for the issue of $100,000 bonds for park improvements.

Duluth, Minn.—This city has purchased the West Duluth park for $4,000 and will add it to the park system of the city.

TOO LATE FOR CLASSIFICATION

Des Moines, Ia.—The contract for paving Twenty-first-st. with asphalt was awarded to the Capital City Brick and Pipe Company.

Oskaloosa, Ia.—This city voted to grant franchises for street railway, electric lighting and city heating plant.

Waterloo, Ill.—Bids will be received until Jan. 3 for an electric light plant. George W. Ziebold, mayor.

Cleveland, O.—Bids are asked until Jan. 7 for furnishing and maintaining 892 electric lights for one year. John Vandevelde, deputy dir. pub. wks.

Colorado Springs, Col.—This city is considering a proposition from the Yaryan Consolidated Company for a heating and lighting plant.

Zionsville, Ind.—Sealed bids are asked until Jan. 8 for an electric light plant. Bert A. Mills, cy. clk.

St. Louis, Mo.—Ordinances were approved Dec. 21 for the reconstruction of six streets.

Greenwich, N. Y.—Bids are asked until Jan. 10 for lighting this town for five years. I. V. H. Gill, vil. engr.

Wilmette, Ill.—The citizens are considering the question of obtaining their water supply from Winnetka, which offers a lower rate than that given by Evanston.

Hagerstown, Md.—The contract for furnishing electrical supplies was awarded Dec. 19 to the General Electrical Company for $3,658.75.

Bonaparte, Ia.—The question of building water works was favorably voted on Dec. 11.

Lebanon, Pa.—Bids will be asked for laying the 20-in. pipe line between Red Bridge and Poplar Run, along the Hammer creek.

Montpelier, Ind.—The city council has purchased the water works system which supplies this city from Kerlin Bros., for $40,000.

Garrison, Ia.—The question of building water works will be voted on the first Monday in January.

Electric lighting plants are contemplated at the following places: Riegelsville, Pa.; Harvey, N. D.; Riverside, Ia.; Frenchtown, N. J.; Mt. Gilead, O.; Pomeroy, Wash.; College Hill, Pa.

Valparaiso, Ind.—Daniel W. Mead, C. E., Chicago, has been engaged to appraise the

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value of the Valparaiso Water Works Company, which this city contemplates purchasing.

New Orleans, La.—The sewerage and water plans were submitted to sewerage and water board Dec. 20. The estimated cost of the system is $10,000,000. Bids can be invited after 90 days.

New Britain, Conn.—The committee on a municipal lighting plant has reported favorably and the matter will be brought before the general assembly.

Newport, Ky.—Van Sandt & Meads submitted the lowest bid Dec. 18 for a system of sewers east of Park-ave., at $27,496.55, and will probably be awarded the contract.

Youngstown, O.—The contract for lighting the streets of the city was awarded Dec. 18 to the Youngstown Consolidated Gas and Electric Company, at $64 per light per year.

Ripon, Wis.—Sealed bids will be received until Feb. 20 for protection curb, vitrified brick paving, iron gutter bridges, wood gutter bridges, cast iron gutters, etc., on Watson-st. O. C. Stickles, chm. B. P. W. Bids will be received until Jan. 3 for a franchise for supplying electric light for illuminating purposes. F. W. Allen, cy. clk.

Philadelphia, Pa.—The contract for public electric lighting for 1901 was awarded Dec. 18 to the Brush Electric Company as follows: 28 cents per light per lamp supplied from city underground cables; 30 cents on overhead cables, north of Allegheny-ave.; 32 cents on lamps supplied by underground cables owned by the company. This bid was conditional upon the Brush company being given the contract for the entire city.

Milwaukee, Wis.—Bids were received Dec. 22 for furnishing naptha lights for street lighting, the lowest one being that of Richard Forrestal, who bid as follows: 18-c. p. lights for terms of from one to five years, $18, $17, $16, $15, $14.75. The other bidders were the American Development Company and the Globe Light and Heat Company.

Marion, Ind.—Through an error in the contract between the Warren-Scharf Asphalt Paving Company and the city of Marion, the company will lose $14,000 on the contract for three miles of asphalt paving on Washington-st. The contract provided for a street only 44 feet wide, while at the alleys and crossings the pavement was 66 feet wide. The paving company had no authority to build these "aprons" at the crossings.

Philadelphia, Pa.—Bids were submitted Dec. 20 for street repairing. For repairs to paved streets for the entire city the bids were as follows: Mack Paving Company, $172,900; Daniel J. McNichol, $224,948; George A. Vare, $248,795; and Michael O'Rourke, $350,000. Daniel S. Baeder and the Vulcanite Paving Company submitted bids at various prices per square yard, according to districts. For the maintenance of unpaved and macadamized highways, small bridges, drains and steps, the bids were as follows: George A. Vare, $70,000; Daniel S. Baeder, $83,400; Walter D. Stone, $97,000; Daniel J. McNichol, $97,990; David McMahon, $109,000; David Peoples, $110,000; R. P. Bennis, $115,000; J. R. Shanley, $147,000. The award of contracts was deferred a week.

Ft Wayne, Ind.—Bids for paving E. Main-st. from Barr to Clay were as follows: Barber Asphalt Paving Company: Section from Barr to Lafayette—Sheet asphalt, $2.40; excavation, 3 cents per cubic yard; new curbing, 4 cents per lineal foot; resetting old curbing, 15 cents per lineal foot; oak heading plank, 10 cents per foot; corners, $3.50. From Lafayette to Clay—Sheet asphalt, $10.31 per lineal foot. Bermudez Company: Section from Barr to Lafayette—Sheet asphalt, $2.47; excavation, 25 cents; resetting old curbing, 18 cents; heading plank, 12 cents; corners, $2. From Lafayette to Clay—Sheet asphalt, $10.57 per lineal foot; curbing, 45 cents.

Birmingham, Ala.—The contract for grading, macadamizing and curbing Twenty-fifth-st., between Seventh and Thirteenth-aves., north, was awarded to C. M. Burkhalter & Co., for $6,842.50.

Mason City, Ia.—Paving is contemplated for State-st., from Adams to College. Petitions are being circulated for laterals to connect with the Willow Creek sewer.

Cincinnati, O:—Sealed bids will be received until Jan. 16 for the construction and repair of all artificial stone sidewalks in the eastern and western districts. Robt. Allison, prest. bd. pub. service.

Camden, N. J.—The contract for macadamizing the River-road was awarded to B. F. Sweeten & Son for $30,615.41, instead of J. W. Ireland of Philadelphia, as stated in the December number of Municipal Engineering.

Portsmouth, N. H.—The Portsmouth Gas, Electric Light and Power Company secured a ten-year contract Dec. 20 for lighting the streets of this city at $1.05 per arc light per year and 75 cents per night for each incandescent light.

St. Joseph, Mo.—An ordinance was introduced Dec. 20 providing for paving Ashland-ave. with asphalt, from Frederick-ave. northwest to the city limits. This is believed to be the first step in a plan to provide a system of boulevards.

South Bend., Ind.—E. E. Brownell, C. E., Dayton, O., in his report on the condition of the water works says that to insure safety the system is in need of immediate attention, and that a new pump is necessary.

Allegheny, Pa.—Contracts were awarded Dec. 19 as follows: Sewer, Wood Run-ave., J. B. Sheets & Co., $3,256; grading Staton-st., John Carson & Co., $11,285; sewer, Williams-st., Sweeney & Houston, $1,189.50; lateral sewer, Iola-st. and Milroy-ave., Harvey Sloan, $1,175.50; grading Bartlett-st., John Carson & Co., $4.420.

Wyandotte, Mich.—A franchise was granted to Gardner & Loeffler Dec. 20 for a $50,000 gas plant. The franchise provides for furnishing illuminating gas at a price not to exceed $1.40 per 1,000 feet and fuel gas at $1.25 per 1,000 feet. A rebate of 15 per cent. is given to customers using over 1,000 feet, and the city is to receive 5 cents on each 1,000 feet sold.

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Municipal Engineering

VOLUME XX. FEBRUARY, NINETEEN HUNDRED ONE. NUMBER 2.

MELAN ARCH BRIDGES IN INDIANAPOLIS.

By B. J. T. Jeup, City Engineer of Indianapolis.

About two years ago the board of public works of the city of Indianapolis considered the question of replacing many of the old steel and iron bridges by new bridges of a more permanent character. Some of the old bridges had been constructed over thirty years and were originally designed as county road bridges, and were not adapted for the heavy loading to which city bridges are subjected. One of the bridges—the old Illinois street bridge—had been frequently strengthened and patched in order to sustain the load of the street railway cars, but its factor of safety was very low. The board of public works at that time decided to replace two of these bridges across Fall creek by new bridges, and, in view of the fact that Fall creek was to be improved and boulevards constructed on either side, it was deemed desirable to construct stone bridges across this creek. It was at first contemplated to have these bridges built entirely of natural stone, but in order to insure a greater water-way without greatly increasing the width of the stream it was found to be more economical to construct these bridges of the Melan arch type. The contracts for two Melan arch bridges were let in November, 1899, for bridges across Fall creek at Illinois street and Meridian street, Illinois street having a double street railway track and Meridian street being the main thoroughfare running through the residence portion of the city.

These two bridges are each skew bridges, the lines of the piers and abutments making an angle of 70 degrees with the street line. Each bridge is composed of 3 arches of 74-foot span. The piers and abutments are constructed of concrete to a depth of 10 feet below the low water level of the creek. The piers are 8 feet wide and the abutments 20 feet. The specifications for the concrete provided for a mixture of 1 part of cement, 4 parts of sand and 8 parts of screened gravel, but in the actual construction the concrete was made with one part of Atlas Portland cement, 3 parts of clean sand and 6 parts of screened gravel. Stones taken from the piers and abutments of the old bridge, which were found in sound condition, were used in the concrete of the new piers and abutments. The concrete for the arches was made in the proportion of 1 part of Alsen cement, 2 parts of sand and 4 parts of screened gravel. The thickness of the arches at the crown is 16 inches and at the piers and abutments 60 inches. Spaced 3 feet from center to center in the concrete of the arches are 10-inch I-beams weighing 25 pounds to the lineal foot. The beams were bent at the mills to conform to the plans of the arch and were shipped in two sections. Each beam was spliced at the center by means of top and side plates thoroughly riveted.

The general specifications for the bridges were such as have been adopted in the construction of concrete arches under the Melan and Thatcher systems. The piers and abutments from a depth of 2 feet below the low water level of the creek were faced with stone, as were also all the exposed surfaces of the sides of the bridge. The stone is oolitic limestone from the Romona quarries. Differing from most Melan bridges heretofore constructed, the railings of the two bridges were built entirely of stone. Photographic views of the bridges, together with views of the work in course of construction, explain more fully the character of the work.

A description of the method of mixing the concrete for these bridges may be of interest. For the Meridian street bridge the

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FORMER MERIDIAN STREET BRIDGE, INDIANAPOLIS.

concrete was mixed by means of a Drake mixer, into which the gravel, sand and cement were fed after they had been partially mixed on an elevated platform. The mixed concrete from the mixer discharged into a box conveyor, as shown in the photograph. This box conveyor extended sixty feet from the mixer, and openings that could be readily closed were provided in the bottom, so that by means of chutes the concrete could be dropped to any portion of the piers, abutments and arches within the limits of a radius of sixty feet from a mixer. This method of mixing and conveying gave a thorough, intimate mixture of all the ingredients, but was open to the objection that the gravel and the mortar separated at times when the concrete dropped from the conveyor. This necessitated a partial remixing of the concrete by hand before it was rammed into place. The method of concreting as employed at the Meridian street bridge necessitated the frequent moving of all of the machinery, the concrete mixers and conveyors.

In the construction of the Illinois street bridge, the handling of the material was done according to a system similar to the one adopted in the construction of the Topeka, Kas., Melan arch bridge. Instead of one line of cable and buckets, as used at Topeka, two lines were used in the construction of this bridge. All of the concrete was mixed at one stationary plant, on the south bank of the creek. In a large funnel-shaped, elevated bin, divided into two compartments, were placed the gravel and sand. From this bin the gravel and sand were conducted, in proper proportions, into a revolving box, to which cement was added. The contents of this box were dumped into a Drake concrete mixer and mixed as long as necessary to procure a proper mixture. The mixed concrete (mixed in batches instead of continuously, as at the Meridian street bridge) was deposited in steel buckets and carried, by cables, extending from towers on opposite sides of the stream, to any place where the same was desired. When proper care was taken in lowering the buckets, it was not necessary again to turn the concrete by hand. A gravity mixer was also used on part of the Illinois street bridge with fairly good results, but the height of the drop was not sufficient at all times to secure a thorough mixture, and the mixer was open to the same objection as the system used at Meridian street, in that it frequently separated the mortar from the gravel.

Numerous tests of the strength of the

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concrete, made from time to time as the work progressed, fully demonstrated the advantages of a mechanical mixer over mixing concrete by hand.

The contract for the Meridian street bridge included the paving of the sidewalks with cement and paving the roadway with asphalt. The contract for the Illinois street bridge included the paving of the roadway with creosoted yellow pine blocks and the paving of the sidewalks with cement. The contract price for the Illinois street bridge, which is 60 feet wide, was $50,900. The bridge was constructed by the Hoosier Bridge Company of this city. Ex-City Engineer H. A. Mansfield and Mr. C. A. Kenyon, of this company, were in charge of the work. The contract price for the Meridian street bridge was $54,440. The contract was let to Shover & Austin of this city.

HEATING FROM CENTRAL STATIONS.*

By Alton D. Adams, M. A. I. E. E., Boston, Mass.

Light and heat are in general demand. Central electric stations meet a part of the demand for light, but the remainder is supplied by other means because of the high cost of electric energy. Distributed electric energy is entirely unable to furnish heat at any price that makes it available for warming buildings, though it finds some application in cooking and the arts.

In spite of the great development that has taken place in electrical apparatus and systems of distribution, there seems small prospect that stations producing only electric energy can ever supply the great bulk of light and heat necessary in any community. The reasons for this limitation of electrical supply are obvious. Dynamos have already reached an operative efficiency of 90 to 95 per cent., so that little more is to be expected in this direction. The source of

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MERIDIAN STREET BRIDGE, INDIANAPOLIS.

their energy is the weak spot in systems of electrical supply.

Aside from the few locations where water powers are available, electric stations are mostly operated with steam engines. With a combined efficiency of 80 per cent. for boilers, economizers and feed-water heaters, that is, 80 per cent. of the total heat energy of coal transferred to the water and steam by these means, and 17 per cent. efficiency for steam engines, corresponding to 13.57 pounds of steam at 175 pounds gauge per brake horse-power hour when feed water is heated to 126 degrees by steam in the condenser, the complete efficiency of a steam power plant is 13.6 per cent. As one horse-power hour is the equivalent of 2,545 heat units, such a steam-power plant consumes fuel containing 18,713 units of heat, or 1.44 pounds of coal per brake horse-power hour, allowing coal 13,000 heat units per pound. While only 13.6 per cent. of fuel energy is delivered at the dynamo shaft and the remainder is wasted, any electrical distribution system starts with little chance to supply cheap energy.

Allowing 90 per cent. for the average combined efficiency of all of the electrical equipment at a central station, and 95 per cent. efficiency for the distribution lines, with the steam power plant just considered 11.5 per cent. of fuel energy may be delivered to consumers as electric current. The remaining 88.5 per cent., or more, of fuel energy goes to waste at the great majority of electric stations.

If boiler plants on the premises of consumers show an efficiency equal to that just assumed for those at central stations, 6.7 times as much fuel must be burned in the latter as in the former to yield consumers an equal amount of heat energy. With electrical energy at 10 cents per kilowatt-hour, it costs as much for heating as coal at $381 per ton, with boilers of only 50 per cent. efficiency. This result is readily computed from the facts that one kilowatt-hour is the equivalent of 3,412 heat units, and that fair coal develops 26,000,000 heat units per ton on perfect combustion.

Illuminating gas, though a form of matter rather than a kind of energy, may be compared with systems of energy distribution, because of its general supply to the public, and the ease with which energy may be derived from it. It should be held in mind, however, that gas can only be applied to the warming of many buildings by com-

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bustion in a boiler furnace, just as coal would be used, while electric energy, steam or hot water may be utilized directly in the room to be heated. The average illuminating gas, at the rate of $1 per 1,000 cubic feet, supplies, on perfect combustion, 650,000 heat units for this sum. If the apparatus in which the combustion of gas takes place yields, as useful heating effect, 75 per cent. of the contained energy of the gas, its cost is equal to that of coal at $26.66 per ton, when the coal contains 13,000 heat units per pound and is burned in apparatus of only 50 per cent. efficiency.

It is thus evident that neither electric energy nor gas can play an important part in warming buildings under present methods of production. The remaining available agents for the distribution of heat from central stations are steam and hot water.

Central heating stations may be, and are being conducted solely for the distribution of heat. In other, and the greater number of instances, the supply of heat is carried on from the same station that distributes electric energy. The independent heating station delivers the steam or hot water from its boiler directly to the distribution pipes. A combined electric and heating plant uses steam in its engines and then applies the engine exhaust to the heating system, either by circulating it directly in the pipes, or by using it to heat the circulating water. In addition to this use of exhaust steam, a combined electric and heating station may devote any desired part of its boilers to the heating system, as desired.

The combined efficiency of boilers and economizers at a central station may be as high as 80 per cent. The proportion of the heat of boiler water or steam that can be delivered to the pipes of a heating system depends on the character of the central station and the quality of its equipment. If the central station is devoted entirely to heat distribution by means of either hot water or steam, the total heat extracted from fuel by the boiler plant may be delivered to the distribution pipes. At central electric stations that distribute only exhaust steam for heating, the portion of total fuel energy that may be sent into the supply pipes drops to little less than 60 per cent. Hot water distribution, from central electric stations, shows a slight gain over the figure just given in the per cent.

MERIDIAN STREET BRIDGE, INDIANAPOLIS—CONCRETING OF ARCHES, SHOWING CONCRETE MIXER AND CONVEYOR.

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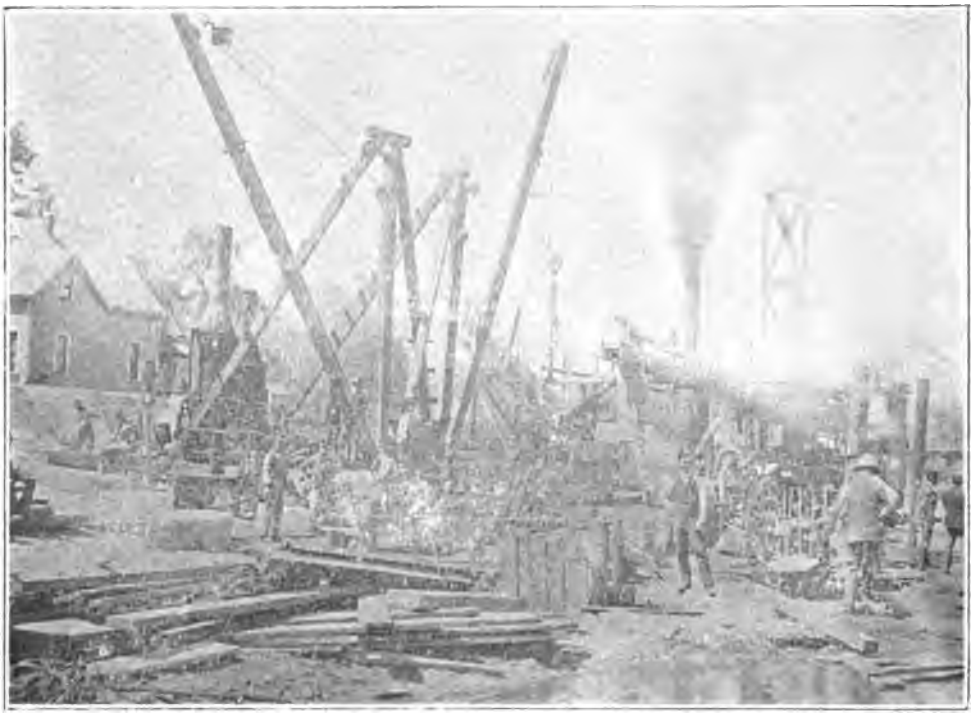

MERIDIAN STREET BRIDGE, INDIANAPOLIS—CONSTRUCTING PIER.

of fuel energy imparted to the heating system by the exhaust steam. In so far as electric stations devote a part of their boilers to the supply of a heating system exclusively, the same per cent. of fuel energy may be delivered to distribution pipes as at an independent heating station.

A simple heating plant may distribute either high or low pressure steam or hot water. An electric station supplying heat with exhaust steam may distribute the exhaust at low pressure or use it to heat circulating water.

The losses from distribution pipes are very material factors in the efficiency of a public heating system, and these losses are subject to large variations according to the kind of distribution adopted and the extent and design of each particular system. Other factors remaining constant, the losses from distribution pipes are greater for a high than for a low pressure steam system, and greater for low pressure steam than for hot water. The actual rates of loss from distribution pipes may well range from 10 per cent. for a hot-water system, extending one-half mile from the station, to 25 per cent. for high pressure steam pipes one-half mile long. Taking a loss in distribution mains of 20 per cent. as a moderate figure, the independent heating system, with an efficiency of 80 per cent. at the boiler plant, is able to deliver to consumers 62 per cent. of the total heat energy of fuel.

At the central electric station transferring about 60 per cent. of the heating power of coal to the pipes of a distribution system, the loss of 20 per cent. in pipes allows the consumer to receive nearly 50 per cent. of the fuel energy. These figures for the efficiency of steam and hot water heating systems compare favorably with those of 25 per cent. for coal gas, 40 per cent. for water gas and 11 per cent. for electric energy, while the first cost of equipment and labor of operation for the steam and hot water systems is much less than for either of the others for an equal rate of energy output.

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SELECTING A SYSTEM FOR FILTRATION OF WATER.

By Floyd Davis, E. M., Ph. D.

In considering a system of water purification for a city, efficiency, original cost and operating expense of a plant should be carefully considered.

With waters free from sewage, high bacteriological purification is entirely unnecessary. The problem is then one mostly of straining, and when there is not too much soluble organic matter present, both English and mechanical filters give good results. When the water contains too much soluble organic or coloring matter, the modified English and mechanical filters give best results, for these substances can be reduced most satisfactorily by the coagulant used. But with waters containing fresh sewage, no better filter can ordinarily be made than an English bed, because it is capable of removing as high a percentage of bacteria, gives more uniform results, and requires less skillful management than a mechanical system. Still, as far as a method of purification is concerned—for waters adapted to it—mechanical filtration will give as good results as can be accomplished by any other process, and the chemical, microscopical and bacteriological tests of the filtrate meet the most critical standards of permissibility that are applied to drinking waters.

Efficiency depends also upon adaptability, and in choosing between an English and a mechanical system, this should be considered. Sometimes a water that will coat over and render the sand quite impervious in an English bed, thereby creating too great an expense for operation, can be handled satisfactorily with mechanical filters; and it is also not infrequently the case that for a small water supply taken from sewage-polluted sources, mechanical filters will not give satisfaction, because the operating expense is too great, and the skill required for management is not at hand. Even with waters equally adapted to each, English filters may give better results than a poorly-managed mechanical system, but when the processes are skillfully conducted, and all the filtered water is used, as is customary when no sewage is present, the purification is as satisfactory from one system as from the other; and each is capable of reducing all suspended and chemical substances be-

MERIDIAN STREET BRIDGE, INDIANAPOLIS—I-BEAMS IN PLACE FOR ARCHES.

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MERIDIAN STREET BRIDGE, INDIANAPOLIS—I-BEAMS SHOWING END CONSTRUCTION.

ow permissible limits, and of entirely removing all pathogenic and other objectionable bacteria.

The cost of constructing an English filter depends upon so many conditions that the exact amount can not be determined beforehand, except by contract, but it is safe to estimate that at present prices for materials, it will cost at least $100,000 per acre for properly constructed covered filters. An average rate of four million gallons per acre in twenty-four hours may be taken for one of these filters, and as it is necessary to have some bed in reserve while cleaning, about one and one-fifth acres are required for this daily amount of water. This will cost at least $120,000. Mechanical filters are rated at $7,000 per million gallons daily capacity, and for the four million gallons the cost is, therefore, $28,000. A suitable building necessary for the filters would cost, with heating appliances, perhaps $7,000 more, making a total expense of $35,000 for a mechanical filtering plant alone, against $120,000 for an English filter of the same capacity. Each system should be provided with a suitable storage reservoir of sufficient capacity for all emergencies, and with all connections and appliances necessary for handling the water. The cost of these is between $20,000 and $50,000, according to their capacity, but they are common to each system.

The main operating expense of an English plant is for cleaning and maintaining the filter bed. The frequency of this becomes a very serious objection to this process for some waters, since it adds too great an expense to the operation. It is estimated that it requires about thirty days' labor to scrape properly an acre of filter and remove and take care of the scrapings. This, at a cost of $1.75 per day, requires $52.50. Then it costs about thirty-two cents per cubic yard to wash the sand, and as an ordinary cleaning removes about one hundred and thirty-four yards per acre, the washing expense may be estimated at $42.88, making a total cleaning expense of $95.38 per acre, or about seventy-nine cents per million gallons of water filtered by a system that averages four million gallons per acre in twenty-four hours for a thirty days' run. But there are waters which clog the filter so rapidly that the expense of filtration greatly exceeds this amount, and this system is entirely out of the question as an economical means of purification; indeed it is an absolute failure. As a part of the operating expense should be added the cost of renewing the filter bed at least once or twice a

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year. The more frequently it is cleaned the shorter its duration, the greater the filtering surface required, and consequently the greater the rebuilding expense.

For the mechanical system, the principal elements of expense of operation are for coagulant and wash-water. The aluminum sulphate used in this is worth about one and four-tenths cents per pound in commercial centers, and can be laid down in carload lots in most interior points for two cents per pound. With a water that requires one-half grain of this to the gallon of water filtered. Supposing that this is lifted twenty feet in washing the filters, the cost of wash-water for each million gallons of filtrate will be about twenty-seven cents. The total cost for these two items per million gallons is, therefore, about $1.69 against seventy-nine cents for an English system, as operating expense; but it should be understood that these figures differ widely for different waters, and may even change so that the operating expense of an English filter will exceed that of a mechanical plant.

MERIDIAN STREET BRIDGE, INDIANAPOLIS, SHOWING CONSTRUCTION OF FACING.

for its purification, the expense is $1.42 per million gallons, but the amount of coagulant varies with different waters, sometimes being several times the amount here represented. Ordinarily the expense of pumping water under sixty pounds pressure does not exceed four cents per million gallons for each foot it is lifted. Three per cent. of the filtered water for washing is undoubtedly sufficient, or 30,000 gallons per million

There are several engineering problems connected with filters, as well as the matter of interest on sinking fund, that should be carefully considered before selecting any filtering process. The best system, including its efficiency and operating expense, should always be determined by preliminary experiment before any plans for improvement are adopted by a water-works company or municipality.

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IMPROVEMENTS OF TRAFFIC CONDITIONS IN BOSTON.

We present four pictures this month to show the improvement in the conditions about the new terminal station whereby greater facility is given for the traffic to and from the freight and passenger stations and to and from South Boston, which is here concentrated in a small area formerly served by narrow and crooked streets without proper outlets. One picture shows the express and freight houses on the Atlantic avenue front of the terminal station. Federal and Cove streets formerly occupied this ground. A bridge to South Boston in extension of this street is urged. The advantage of a wide and straight street in preventing congestion is clearly shown. Dorchester avenue, in the rear of the station, is shown in the second view. This is a new street with sea wall constructed to take the place of Federal street and to give a thoroughfare to South Boston. A third view shows the corner of the terminal station at Dorchester avenue and Summer street. Summer street has been widened and rebuilt at this point and at the entrance to the new Summer street bridge, which has been open to traffic for a year. It would be impossible to conduct the present business in this district and that which must pass through it, without the radical reconstruction which the present condition demonstrates to those who have ever visited the district when it was laboring under the difficulties of narrow and crooked streets and bridges.

Another improvement of magnitude is the new Charles river bridge, shown in the fifth view. It replaces a bridge which was built in 1786, and is now to be torn down. This is shown in the view, and a comparison of the two bridges shows the advance in the science of bridge construction as well as the necessity of increase in facilities for traffic.

THE AMERICAN CEMENT INDUSTRIES.

The development in the United States of the manufacture of cements, especially of more or less strictly artificial or Portland cements, has been phenomenal in its extent and rapidity in the past ten or fifteen years, and especially so in the last five or six years. MUNICIPAL ENGINEERING has paid the large amount of attention to cement and its uses which so important a material in engineering construction demands, and has been in the advance column in its presentation of the demonstration of its value in the many new uses to which it is put. A department devoted to cement was carried on by an expert in its inspection and use until the subject outgrew the limits of a department and extended through all sections of the magazine. The commercial test is a valuable test and doubtless the most popular one. Measured in this way, the service of the magazine has been eminently satisfactory, for the advertising pages show a steady and rapid increase in the amount of space occupied by the manufacturers and sales agents of Portland and natural hydraulic cements.

The publication of several books upon natural and Portland cements, and the increased space given these materials in books on the materials of construction, are additional signs of the growing importance of the material in engineering construction.

The industries to which this increased use of cement has given rise have found the need of a book which shall be devoted especially to the subject of cement, and which shall cover the whole subject as far as it has been developed. This want, and the facilities which this magazine has for satisfying it, have forced the management to the conclusion that it should undertake the publication of such a book. Its preparation will be in charge of the editor of this magazine.

There will be two principal divisions in the book, one a directory of the industries connected with the manufacture, sale, and use of cement, and the other a hand-book for the cement user.

In the first division will be a list of the manufacturers of cement; a classified list of the various brands of cement on the market, American, Portland, and natural hydraulic and foreign Portland cements, giving the names of the manufacturer of each brand; a list of the names and addresses of the general sales agents and the companies they represent; a list of the dealers in cement in cities and towns throughout the United States and Canada; a classified list of those interested in the use of cement, whether architects, engineers, contractors or cement workers; a list of the cement testing and analyzing laboratories, governmental, municipal or private; lists of the

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FREIGHT AND EXPRESS BUILDINGS ON ATLANTIC AVENUE FRONT OF NEW BOSTON TERMINAL STATION.

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makers of machinery for the manufacture and the manipulation of cement. This directory is something which has never before been attempted, and the greatest care is taken to make it accurate and extensive enough to cover fully the field described.

The hand-book is a text-book upon the manufacture and use of cement, which will contain a large amount of information for all those whose names will find a place in the directory, and in addition to engineers, contractors and other persons who use small quantities of cement, or who are considering its use in their work and in preparing specifications for the same.

There will be a brief sketch of the cement industry in this country, a statement of the principles upon which the various processes of manufacture are based, brief descriptions of the cement factories and their methods of manufacture so far as the officers are willing to have them published, tables of chemical analyses, and the results of tests of quality. Standard methods of testing and specifications for testing cement of the various kinds and for various duties required of it will be given in detail. An important feature for the cement user will be full specifications, or descriptions of methods, for the use of cement in all classes of building and engineering construction; mortar for brick and stone masonry; concrete for many various purposes, that for which natural cement is used and that for which Portland cement is used; concrete piers and abutments; cement mortar for plastering cellars, cisterns, walls, piers and abutments; street foundations; cement sidewalks; building foundations; etc., etc. This section will be made as complete as possible, that it may contain the best methods of doing work of all classes and specifications for the construction of the same, which are now scattered through books, engineering and trade periodicals, trade publications, engineers' specifications for municipal and other public work, railroad and architectural construction and the like.

The result will be a book containing a large amount of information and instruction concerning the manufacture and the manipulation of cement, for every person interested in cement in its progress from the quarry, marl bed or slag pile to its place in the completed structure. The directory features add very largely to the engineering interest, giving the business standpoint and full information to the consumer as to where to get the cement desired, and to the producer as to where to sell the product he manufactures.

Cement making machinery and machines for handling cement and concrete in engineering work will have a prominent place in both directory and hand-book. This is another branch of the subject in which this book is a pioneer.

In short, the book is expected to fill the expressed needs of the cement and allied industries, to collect the best information and instruction extant within its covers and to give some new classes of information, especially in its directory, which have never before been attainable in any form whatever.

EDITORIAL COMMENT.

Street Cleaning Specifications.

The consequence of difference in conditions and in specifications for street sweeping and cleaning is shown by the difference in the bids for this year's work in Indianapolis and in San Francisco. The former city has been noted for some years for the cleanliness of its streets, and will pay this year 18¼ cents for sweeping and removing the sweepings from each 10,000 square feet of space. Extra amounts are allowed for day hand labor in small quantities as ordered by the board of public works. San Francisco is making a strong endeavor to relieve itself of the dust and mud nuisance to which it is so subject, and has prepared a very elaborate specification for street sweeping and cleaning under which the contract has recently been let for 1901. First-class streets in District No. 1 are all cleaned by day hand labor every day except Sunday at a contract price of 77 cents for 1,000 square yards, equivalent to 86⅓ cents for 10,000 square feet or nearly five times the cost in Indianapolis. Streets of other classes in this district are cleaned at night by machine, some every night, some three times, some twice, and some once each week, and a few once in two weeks. The contract price for these streets is equivalent to 76⅔ cents for 10,000 square feet.

The price for District No. 2, all classes, is equivalent to 43.6 cents for 10,000 square feet. The various classes of streets in this district are swept once a day, twice and once a week, once in two weeks, once a month.

Some statement of the requirements in San Francisco will be of interest. Hand

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DORCHESTER AVENUE AT REAR OF NEW BOSTON TERMINAL STATION.

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labor must all be done in the day, except on the most crowded streets. Machine work must all be done at night. Reductions in schedule can be made for lack of money to pay for the work, but the contractor will receive forty per cent. of the contract price for the amount of work taken off, provided he leaves the streets as clean after each sweeping as though the number of sweepings had not been reduced. The contractor must notify the board each morning of the routes of his cleaning gangs for the following night and the next day. Dust must not fly during sweeping under penalty of fifty cents for each block in which it is caused to rise. Sweeping contractor must sprinkle if the street is not kept sufficiently moist by the sprinkling contractor, if any. On streets of the first class the contractor must keep sidewalks clear of papers, etc., except sweepings from stores. The minimum number of men to be employed on certain of the first-class streets is prescribed in detail. Enough more must be employed to keep these streets clean at all times. Reductions in payment for deficiencies in number of men are provided for. When work is suspended on account of rain or otherwise, the payment per hour for the time spent on the streets will be one-eighth of the amount allowed per day for full time. When conditions require it, in the opinion of the board of public works, the asphaltic pavements must be flushed by sprinkling carts at an extra charge of $1 an hour for each cart, including teams, driver and water. The streets so flushed must be scraped with rubber scrapers by the regular force without extra charge. Streets broken or under repair will not be swept or paid for. In rainy weather at least thirty-five men must be detailed to keep cross walks clean at an extra price of fifteen cents for each walk so cleaned, provided the work on the walk is begun before 1:30 P. M. At least 450 dirt receptacles must be furnished of specified character, also all machinery and tools. Sweepers wear white uniforms, paid for by them at $2.25 each. Special crews of team, driver, wagon and three laborers for cleaning gutterways and crossings, according to schedule and specific orders, are provided for at an extra price of thirty cents an hour for each laborer, and fifty cents for team, wagon and driver. Not more than twelve laborers are to work on holidays and Sundays from 6 to 10 A. M., at an extra cost of thirty cents an hour for each man. Four dumping districts are specified. Sweepings from any one of these districts are to be dumped at any specified place within that district. Any load diverted from the place required subjects the contractor to a fine of $1.

Wages are fixed at $2 for an eight-hour day, payable twice a month, without commission or retention of more than one day's pay. Contractor may board teamsters at 50 cents a day, and furnish room at 15 cents a day. He can not do this for other laborers.

Reports of cleaned streets are made at specified times, inspection is made, fines deducted, and payment is made monthly.

The Indianapolis specifications are simply to keep the streets clean to the satisfaction of the board. If street car tracks are bouldered they must be cleaned once a week; if graveled, they must be sprinkled enough to keep the dust down at all times. Various classes of streets are swept four, three, two and one time a week, by machine at night. Hand labor may be required during the day for streets selected by the board, and will be paid for, extra, at $1.35 a day for labor; $2.50 for horse, cart and driver; $3 for two horses, wagon and driver; $4 for 2-horse scraper and driver; $5 for four-horse scraper and driver.

Vitrified Pipe for Water Conduits. The paper presented before the Connecticut Civil Engineers' Association, upon the vitrified pipe conduit of the Hartford waterworks, by W. E. Johnson, selections from which are presented elsewhere in this number, gives in full detail the method of using this material for water supply mains. There are a few lines of similar pipe scattered about the country, which seem to give excellent satisfaction. One peculiarity about their use is that they have been adopted by towns whose sources of supply are located in rather rough country where the problem of location of a line with a uniform gradient is difficult of solution. The one described seems to have been satisfactorily worked out.

A very detailed specification of prohibited defects in pipe is a part of the original paper. Too much trouble can not be taken in this regard if the expected results are to be reached and the pipe line is to continue in use without frequent repairs. The result of this care is shown in this instance by the observed discharge of the pipe, which is over thirteen per cent. higher than that computed. Reduction in flow to any marked extent by deterioration of the inner surface of the pipe is not to be expected, as is usual with iron pipe, and the conduit will probably be easier to clean than one of iron and will not need it so frequently.

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BOSTON TERMINAL STATION AT CORNER OF DORCHESTER AVENUE AND SUMMER STREET.

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There is one detail of construction mentioned and shown in the photograph which accompanies the article, which is of interest, and the effect of which should be carefully observed. Instead of forming the bottom of the trench and compacting it so that the pipes will rest for their full length upon the ground, the bottom was excavated slightly below the grade line and saddles made of strips of two by four by fifteen inch blocks were firmly imbedded in the soil at intervals of three feet (the length of a pipe) and these serve to support the line. It is stated that the soil is underlaid by rock quite close to the surface, and in some cases rock excavation was necessary. The query which suggests itself is whether the concentration of the weight of the pipe upon these supports will not cause a greater variation in settlement than a careful preparation of the bottom, and thus increase the possibility of leakage at the joints and breakage of bells or of pipe bodies. Reports upon such details as this seldom find themselves into print. Some report of the action of the conduit at Amsterdam, N. Y., has been made, as well as of its method of construction, and when this conduit requires inspection a similar report should be made. The Amsterdam conduit was laid more nearly according to the usual method of laying sewer pipe, more care being taken with the joints, so that leakage was reduced to a minimum.

The Agitation for Municipal Ownership. One of the signs of the widespread interest in the consideration of the question of municipal ownership and operation of public service utilities is the selection of some form or some branch of the subject for debate by college and school societies and for intercollegiate debates. The state normal schools seem to be closer to the people and more nearly representative of the tendencies of thought of the solid body upon which depends the continuity of our institutions. If this is so, it is evident that the people who have the final decision are searching for light upon this important matter, for in some phase it is among the most common subjects for debate, and for essays and orations as well.

The subject of the interstate debate among state normal schools in states around Iowa for this year inquires whether it is advisable to turn over to the cities, immediately and unconditionally, the management of such business as tends to become a monopoly. Such a form of the question as this seems quite impossible to those who have been studying the question most seriously, and is especially unfortunate for discussion by those who are getting their first idea of the subject. It is in form to give good play to the forensic ability of the contestants, to give the prize-ring flavor to the debate which so often appears, but it is hardly possible for the best informed debater with the true spirit of search for the truth to give any adequate idea of the subject. In fact, the question can not be debated upon its merits. What is possible in one city is altogether impossible in another. What can be tried with some hope of success in one city is doomed to certain failure in another. On the principle of suffering the ills we have rather than fly to those we know not of, the general question would be answered in the negative; but progress would be delayed in a number of cases by applying this answer. Like most of the questions of the practical application of theoretical conclusions in this field of municipal ownership and control, this one can not be answered with any satisfaction in its general form, but the local conditions and tendencies have a very large influence in making the decision.

It is quite possible that the discussion of questions in such form as this delays to some extent the logical development of the subject. Both sides, in such a debate, are very likely to be wrong in the principle upon which their contention is based, and are quite sure to turn their arguments from their legitimate channel to make them the most telling for the present purpose. Immature judgment often fails here, and injury is done the cause in the minds of the hearers who are not students of the subject. Prejudices are thus aroused which long prevent the minds of participants and hearers from listening to proper presentations of legitimate arguments.

A similar criticism has been made of some discussions in national societies formed to consider municipal matters, but more mature judgment, more information and continued study have opportunity in such cases to correct the errors made in the early stages of the discussion.

Public Lighting Symposium. It has been suggested that one statement made in this department last month might be construed as questioning the accuracy and honesty of the articles usually appearing in the pages of Municipal Affairs, the quarterly publication of the committee on city affairs of the New York Reform Club. A careful reading of the sentence in question will cor-

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NEW SUMMER STREET BRIDGE, BOSTON. NEW BUILDINGS FOR WOOL TRADE AND RAILROAD TERMINALS BEYOND.

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rect such a misapprehension. The tone of the discussions which appear in that periodical is so temperate, and the arguments favoring the positions assumed are so carefully made that anything which appears in its pages carries more than usual weight. It is the medium for much of the best work of those prominent and influential in promoting desirable municipal reforms. Its reputation for strength and for trustworthiness is therefore unassailable.

This does not, however, cause a modification of the statement that the conclusions drawn are not always strictly reliable on account of the practical impossibility of taking full account of all the circumstances of every case. Thus it would not be safe to apply the average result of municipal ownership in England, as stated by Mr. Maltbie in his paper on "Gas Lighting in England," to any particular city in that country which is proposing to "municipalize" its gas plant, with the expectation that that result would be realized in the new application. There are many personal and local peculiarities which materially modify the details of the development of such a project. The fundamental theoretical principles are the same, but custom, personal preferences, political conditions, all have their important parts in preventing the complete and successful application of these principles. One of the circumstances which has not received sufficient emphasis in this paper is the number of failures which have occurred in municipal operation of such plants. The conditions which bring about such failures should be studied and stated as a guide to those under similar conditions and a warning of the difficulties to be encountered. The reports of failures are much more important than those of successes. While, therefore, the conclusions reached in the paper may be drawn very properly from the data given, they are not entirely reliable for application to any particular case on account of the possible omission of some very important modifying circumstances. Still less could the conclusions be applied directly to cities in America.

Again, in Mr. Fairlee's discussion of "Municipal Lighting in Detroit," the argument depends very largely upon such items as the percentage to be charged for deterioration of plant. The assumption of a different percentage from that given in the paper would materially modify the conclusion as to economy of municipal operation. A complete discussion from data of practical construction, maintenance and operation has never been made. Until it is made, any conclusion drawn from the comparison of data into which this item enters can not be thoroughly reliable. There are great differences of opinion among experts upon this subject, and it is one which is under constant consideration. Data upon which to base reliable conclusions are accumulating and will be considered as opportunity offers. In the meantime assumptions of percentages of loss must be accepted with caution.

The use of the words, "not reliable," was not intended to convey any hint of dishonesty of purpose in collecting or discussing the data offered. The introduction of the word into the English language is too recent for it to have degenerated, as words do, and to be restricted to its least honorable meaning. The intention was to express the fact that summaries of statistics, averages of conditions and conclusions drawn from such summaries and averages can not be relied upon as a safe guide for any particular application. Better direction is almost always found in reports of particular cases under similar circumstances, with such modifications as the results of the general discussion indicate to be advisable.

Uses of Portland Cement Concrete.

A large majority of the railroad superintendents of bridges and buildings use Portland cement concrete in important work. Thirty-three of the replies to the report of the committee of their association describe the character of the structures in which Portland cement is preferable. The division between the use of natural and of Portland cement is usually made with care, and the average rule is quite safe for builders of such structures to follow.

Half of those sending answers use Portland cement in both foundations and neat work of bridge piers and abutments. Two use it in foundations only. A few use Portland cement in concrete above ground and natural cement below, the exact line being drawn in one or two cases at two feet from the weather.

Portland cement is used in all classes of foundations by eleven roads, in culverts by ten, in arches, both foundation and neat work, by six, in retaining walls, both foundation and neat work, by eight, in the foundations only of arches and retaining walls by one. Other classes of structures in which its use is mentioned are pedestals, copings, facing and repairing old stone masonry, dams, cylinder piers, facing decaying stone ledges, salt water foundations, wet foundations and those where loading is excessive, engine beds, cement floors, walls up to water table, etc.

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NEW CHARLESTOWN BRIDGE, SHOWING ALSO THE OLD BRIDGE OF 1786, WHICH IT SUCCEEDS.

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The statement of one engineer seems to cover the general custom, namely, that Portland cement concrete is used in lieu of rubble stone masonry. It is also used in place of brick work by some, and the interior and underground portions are made with natural cement by a few. Several use Portland cement concrete in place of almost all stone masonry, both hearting and face work.

Proportions of materials used vary with the strength required, the exposure and the opinions of the superintendents. In but one case do more than two men report the same mixture. Seven report the proportions for foundations at approximately one part Portland cement, three parts sand and six parts broken stone. The corresponding popular mixtures for natural cement are one, two, and five or six respectively.

One part Portland cement, one part sand, and two parts fine broken stone, is used by one road for copings and bridge seats.

One part Portland cement, two parts sand is used by one for parts receiving direct pressure from superstructure. Four parts of stone are added for arches, coping bridge seats, pedestal stones, facing old masonry, foundations; one or two increasing the amount of stone to five parts, and one or two increasing it for foundations to six parts.

A mixture of one part of Portland cement and two and one-half parts of sand is used for neat work, arch rings and parapets, with five or six parts of stone, and in one case three parts of gravel and four parts of broken stone.

A mixture of one part of Portland cement with three parts of sand is most popular. It is used neat for outside shell and coping by one, with four or five parts of stone by others. Nearly all use either five or six parts of stone with this strength of mortar, two or three increasing the amount of stone to seven parts, and one to seven and one-half parts for ordinary wet foundations and culverts. The proportions, one, three and five or six, probably agree most nearly for the stone used with the requirement that the sand should be just sufficient to fill the voids in the stone, and the cement is in sufficient quantity to develop all the strength of masonry needed.

Two persons use one part cement and three and one-half sand, with six to eight and one-half parts of stone for foundations of light buildings and culverts. Four persons use one part cement and four parts sand, with seven to ten parts of stone for similar purposes. Except for the largest proportion of stone named these proportions again correspond quite closely with the requirement named, the smaller proportion of cement giving a concrete with less strength, but doubtless sufficient for the duty required, and therefore following good engineering practice. The committee states the requirement in this form: "It is our individual opinion that the proper procedure is by careful study and experiment to determine the cement and sand mixture giving the requisite strength for the work in hand, and then to add broken stone in such quantity that the mortar will be slightly in excess of the voids in the stone. The New York Central Railroad uses one cement, four sand, seven and one-half broken stone with rubble fillers for footings; one, three and six respectively with rubble fillers for abutments; one, two and four for facing old masonry; one, one and two for coping and bridge seats. A similar variation in proportions for similar uses is made by other roads.

ANSWERS TO QUESTIONS.

HEATING POWER OF NATURAL GAS.

Where can I obtain information on the heating energy of Indiana natural gas as compared with that of a ton of coal.

Oliver H. Bogue, City Attorney,
Wabash, Ind.

The twenty-third annual report of the state department of geology, for the year 1898, gives some information on this point. One pound of average Pittsburg coal yields 13,066 B. T. U. One pound of average Indiana coal yields 12,382 B. T. U. One cubic foot of natural gas yields 1,164 B. T. U. One British thermal unit (B. T. U.) is the amount of heat necessary to raise one pound of water one degree Fahrenheit in temperature.

Theoretically, therefore, one pound of Pittsburg coal equals 11.2 cubic feet of gas and one pound of Indiana coal equals 10.6 cubic feet of gas. Practically, the report states, one pound of Indiana coal is equal to 10 cubic feet of Indiana natural gas.

Mr. Alton D. Adams states in his article on "Public Gas Supply," on page 384 of the number of MUNICIPAL ENGINEERING for December, 1900, that one cubic foot of natural

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gas yields 1,000 B. T. U. This is a convenient figure for ordinary comparisons.

DESIGN OF HOUSE DRAIN.

What is considered to be the proper size for vitrified pipe house drains? What should be the minimum grade? I have established a minimum grade of 2 per cent., but have been obliged to use 1.5 per cent. in some cases to drain wet cellars.

Is there any objection to connecting cellar drains with house drains, providing connection is made through a trap with backwater valve, or by draining water to a brick basin and trapping with a bend in the outlet pipe which dips well below the surface of the water in the basin? It is very essential that all ground water be drained away from fresh air ducts of furnaces. I have found them entirely closed with ice, and in other cases a foul odor was noticed in the house when water collected in the duct.

Subscriber,
Great Falls, Mont.

The size usually selected for vitrified pipe house drains is 4-inch. Experience indicates that under the same conditions of ordinary house service pipe of this size is less liable to stoppage than that either larger or smaller. If there is a large amount of water used in the house, or if it is a large double house, the pipe should be enlarged. If the amount of roof-water is likely to be large on account of large roof area and heavy rainfall, a larger pipe may be desirable. The gradient for a 4-inch house drain is usually given as at least 2.5 per cent. The amount of water used and the frequency of flushing discharges from water closets, tubs and the like, modify this statement. If the gradient must be much below 2 per cent. it will be advisable to make the line easily accessible, by means of a manhole or clean-out chamber, and to arrange connections so as to insure the full effect of all flushing discharges. A connection in one house on a low gradient may run indefinitely without stoppage and one in the next house be subject to frequent stoppages, the difference being in the habits of the occupants of the houses regarding matter discharged into the sewers, amount of water, frequency of flushing, use of chemical cleaners, etc.

A cellar drain trapped as suggested should give satisfaction, except when a continued dry season cuts off the supply of water long enough to allow evaporation of the water in the trap. The basin must be water-tight so that it will not lose the water by leakage at such times, and the surface of water exposed to the air should be as small as possible, that evaporation may be reduced to a minimum. A vitrified clay or protected iron basin may be better than one built of brick. It should have depth rather than large diameter.

BOOKS ON PLUMBING AND SEWERAGE.

I want some information as to recent books on house plumbing and connections with sewers. We have just completed our system of sewers and this office must superintend the connections.

Geo. W. Carpenter, City Engineer,
Watertown, S. Dak.

The last edition of Staley & Pierson's "Separate System of Sewerage" ($3) and Folwell's "Sewerage" ($3) both contain much of value in the actual work of constructing such connections as well as in designing them. Books on plumbing, with the sewer connections as a part of the house system, are Gerhard's "House Drainage and Sanitary Plumbing" (50 cents), and "Recent Practice in the Sanitary Drainage of Buildings" (50 cents); Coleman's "Sanitary House Drainage, English Practice" ($2); Waring's "How to Drain a House" ($1.25). For the engineer's purposes their relative value is probably in the order they are named. See also "Design of House Drains" in this department.

JOINT USE OF SEWER CONNECTIONS.

In some cities the ordinances regulating sewer connections require that each building shall be separately and independently connected with the lateral sewer. The laterals in our city are all in the alleys at the rear of lots facing on the avenues. Quite frequently two dwellings are built on one lot, and occasionally a row of houses is built on two lots, the houses facing the street running at right angles with the avenue, which makes the connection of several houses with one main drain desirable, if not absolutely necessary. In the construction of house drains, solid and shale rock is frequently encountered, and the extra length of trench in making separate connections makes them quite expensive, especially when it is necessary to drain wet cellars seven or eight feet deep. What are the objections to the joint use of house connections aside from the fact that a change of ownership may complicate matters, and can this objection be overcome?

Subscriber,
Great Falls, Montana.

In some cities it is customary when sewers are laid in streets, to run a single connection from the sewer to a point inside the curb line for each two lots, opposite the line between them, placing a Y at the end so that each of the property owners can make connection without running to the sewer. These lines from sewer to curb being put in with the main sewer, the cost of making connections is materially reduced. The only trouble which can arise is as to the responsibility for any stoppage which may occur in the joint part of the connection. These are not frequent and can be cleaned out from the sewer, unless the separate system with its small sewers is in use. There may be occasional small controversies in such cases. With sewers in alleys these double connec

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tions are not necessary unless there are the exceptional conditions mentioned.

There should be a city ordinance regulating connections with sewers and requiring the approval of the city engineer or board of public works for the portion of a house connection outside of the buildings, as well as the approval of the building or the plumbing inspector for the house system. This will enable those responsible for the sewer system to have the connections made in the best manner possible in each particular case and reduce to a minimum the number of cases where future controversies may arise. Some cities have ordinances and regulations regarding the connection of private sewers with the public main sewers, and regarding additional connections with such private sewers, which have been prepared to cover the conditions arising when a new public system is constructed where some private sewers are already in use. Some of the provisions of such an ordinance would be of value in this case. 1. If the sewer, upon inspection by the city engineer, is satisfactory it may be adopted by the city as a branch sewer and placed under the same regulations regarding connections with it, methods of cleaning and paying for the same, etc. This can not be done unless at the same time the city is given right of way, which is duly recorded, for purposes of taking care of the sewer, and should not be done unless a manhole or flushtank or a lamphole and flushout pipe is put at the end of it. 2. The original owner of the sewer may be permitted to connect with the city sewer provided he will accept the requirement that he keep the sewer clean so long as he owns any portion of the property, and the obligation is transferred with the deed to some definite portion of the property. In such cases there should be a provision that additional connections can be made, up to the capacity of the sewer, by other persons along the line, provided payment is made to the owner of the sewer of a proper sum for such connection. All such connections must be approved by the city engineer, and in case the amount to be paid for the privilege of making the connection can not be agreed upon, the city engineer or board of public works should be required to fix the proper sum after consideration of the special conditions in the case.

Such regulations remove very nearly all the chances for trouble, and if the city engineer is made the responsible party to make the decisions in contested cases, the cases of serious controversy will be exceedingly few.

STREET SPRINKLING WITH SALT WATER.

I desire some information regarding the best methods of street sprinkling with salt water. Does the salt damage certain classes of goods exposed for sale in places of business?

C. H. Topp, City Engineer, Victoria, B. C.

The street superintendent at Oakland, Cal., will be able to give some valuable information upon this subject. San Francisco has also had some experience. So long as the streets are kept damp, so that the dust will not fly, there can be no damage to goods. Salt in the dust would probably have an effect somewhat more injurious than the ordinary dust. If the streets are kept clean and accumulations of dirt and dust worn from the wearing surface of the softer pavements, such as macadam, are promptly removed, this trouble will be reduced to a minimum. Rain storms will wash the accumulations of salt away from clean streets whose drainage is properly taken care of. Salt water has more effect in laying dust and keeping it moist than fresh water.

TARRED MACADAM PAVEMENTS.

I wish to get what information is available regarding the building of tar and gravel street pavements, cost, method of laying and results. Can you refer me to some engineer who has had some experience?

Eug. L. Willard, C. E., St. Mary's, Pa.

The most serious attempt at experiment on this sort of pavement is that at Hamilton, Ont., where a sufficient length of pavement has been laid to give a good idea of the possibilities of the method. Descriptions of the pavement, giving method of laying, components of the pavement and reports from observers of the success attained, will be found in the last volume of MUNICIPAL ENGINEERING on pages 283, October number, 362, November number, and 423, December number. The city engineer of Hamilton will doubtless be willing to make a statement of his opinion regarding the pavement. Broken stone, filled with sand, was used in this case, but it is probable that a proper mixture of sand and gravel would be equally satisfactory.

MACADAM FOR SMALL CITY.

We want information regarding the cost, lasting qualities and value of macadam pavements, as a basis for consideration of the matter by our city council, which can proceed to construct, under the Barrett law, if the business men can interest them in the matter.

H. M., Connersville, Ind.

The pages of MUNICIPAL ENGINEERING MAGAZINE are good sources of information.

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Among recent articles are, "Tar Macadam," on pages 283, 362, 423; "Sandstone for Macadam," on page 25, and "Initial Steps in Getting Good Roads," on page 1, Vol. XIX, July-December, 1900. "How to Construct a Macadam Pavement for Heavy Traffic," on page 168; "How Fine Should Macadam Stone be Crushed," on page 35; "Road Making in Massachusetts," pages 330. 332 and 333, of Vol. XVIII, January-June, 1900. "Macadam for Streets," very closely fitting this question, on page 80: "Importance of Drainage in Making Good Roads," page 216, of Vol. XVII, July-December, 1899; "Scientific Road Construction in Massachusetts," page 256; a list of previous articles on the subject on page 245 of Vol. XVIII, January-June, 1899.

Good books on the subject are Spalding's "Roads and Pavements," and Byrne's "Highway Construction."

Estimates of cost and opinions as to the most economical method of construction can not be offered without knowledge of local conditions, proximity and cost of material of different kinds, etc., best made by an engineer or a man with much experience in building and repairing roads.

THE TESTS FOR PAVING BRICK.

What are the constituents of a good vitrified brick, chemically?

To what processes of test should brick be subjected if several different kinds are to be compared?

Would subjecting them to an absorption test and the attrition of heavy wheels be sufficient?

J. M. Bandy, City Engineer,
Greensboro, N. C.

The chemical constitution of a finished paving brick is not usually determined, the variation in proportions of material being rather too large for accurate comparison of bricks, and other methods being much more satisfactory and more easily applied. Johnson gives "the average composition of the shales that have proved eminently satisfactory for making paving brick" as follows;

Silica ($Si\ O_2$), 56; alumina ($Al_2\ O_3$), 22; ignition loss (chemically combined water), 7; moisture ($H_2\ O$), 2 per cent.; total non-fluxing constituents, 87 per cent. Sesquioxide of iron ($Fe_2\ O_3$), 7; lime ($Ca\ O$), 1; magnesia ($Mg\ O$), 1; alkalies ($K_2\ O\ Na_2\ O$), 4 per cent.; total fluxing constituents, 13 per cent.

The full programme of tests includes cross breaking, crushing, the rattler test and absorption. There is some difference of opinion as to the relative value of these tests, but the limitations of the ordinary apparatus of the city engineer usually reduce the number to the last two. The standard rattler test is more satisfactory than any attempt to subject the brick to any approximation to the conditions of traffic. It subjects all the brick in the rattler to the same impact and attrition and thus produces results which are fairly comparable. The conditions should approach as nearly to the following as possible in order to make comparisons with results obtained by others, but for local use some variation can be made if circumstances require: A rattler 28 inches in diameter and 20 inches long; 75 pounds of "shot," cast iron blocks $2\frac{1}{2} \times 2\frac{1}{2} \times 4\frac{1}{2}$ inches with half-inch round edges; 225 pounds of similar shot, $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2}$ inches with rounded edges; not more than 12 brick; 1,000 revolutions at a speed of 20 to 30 revolutions a minute. The absorption test must be made on broken brick or on those which have been subjected to the rattler test. For the greatest accuracy, they should be thoroughly dried before immersing in water.

These two tests, if the brick under study is compared with one which has given satisfaction in pavements, are usually considered sufficient, though some experimenters insist upon the cross breaking test as one of great value.

VEGETABLE GROWTH IN WATER PIPES.

Ordinarily we get our water supply from tube wells about 45 feet deep, but during the past season, owing to large improvements being made we have taken a great amount of water from an open well in order to keep the water down and away from the pump and building foundation which are being built. The water entering the pumps, either by direct suction or from the open well, appears very clear and free from sediment, but after entering the mains and in certain sections of the city, especially in the center of the city, we are having trouble with a peculiar substance which shows traces of spores and a fungus growth. We have never had anything that has affected the water just the same as this before this time; I can add that for the past two years we have not used the open well very much, having taken direct suction from the tube well system; this may have had some effect on the water, as well as an unusually dry season—the average deficiency in rain-fall being about 11 inches. Our pumping since this was noticeable has been an average of about 6,500,000 gallons daily at a domestic pressure of 60 pounds, and the large mains show little effect of the trouble. Having recently become a subscriber to your magazine, we take the liberty of asking if you can enlighten us as to the cause of our trouble, and if so, have you any remedy? We have flushed the pipes very heavily recently, and that has very materially helped the matter. Is it possible that this is a growth formed in the pipes? Any information that you or your subscribers can give on the subject will be appreciated.

Chas. E. Rowe, Secretary Water-Works,
Dayton, Ohio.

It is evident that the temporary supply used was infected with some of the plant life which gives trouble by its growth and subsequent decay in the pipe system. Among

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these organisms some varieties of fresh water sponges and crenothrix are perhaps most common and most likely to be the causes of the present trouble. That the trouble is of this nature is indicated by the fact that it does not occur in the larger supply pipes where the current is swifter and more nearly constant, but in the smaller distribution pipes where the current is more intermittent and less rapid except when pipes are flushed in case of fire or for cleaning them.

The exact nature of the organism producing the trouble can be determined by the water biologist upon careful microscopical examination. This knowledge, with information of the chemical properties of the supplies of water available, will aid in forming a judgment as to the treatment necessary to reduce the trouble if not entirely eradicate it. In the meantime systematic flushing of the pipes in which the trouble occurs will keep it within bounds. It is possible that the return to the former source of supply will shortly cut off the supply of food for the organisms, at least in part, and thus reduce their numbers. These organisms, however, find much food in ordinary ground waters, and once introduced into the pipes may remain to give trouble constantly or intermittently.

Perhaps some of our subscribers will be willing to send in reports of their successes and especially of their failures under similar circumstances.

RATE OF WATER FILTRATION AND AMOUNT OF COAGULANT NEEDED.

In an excellent article by Mr. Floyd Davis, E. M., Ph. D., on "The English System of Water Filtration," published in your December number, 1900, page 394, Mr. Davis gives "head of water, between unfiltered and filtered, from a few inches to about 80 inches, as giving good results." Now, even if the flow through the filtering medium increased only in direct ratio to the head, and assuming the "few inches" as 8 inches, while the greater head is 80 inches, the rate of filtering might for the 80-inch head be ten times as great as for the 8-inch head; but if the flow through the sand increases as gravity or as the square of the depth or head, the velocity might be not only 10 times as great but 100 times or less, depending on the thickness, fineness and consequent retardation of the filtering medium or obstacle to its free flow through space. Such differences of velocity could hardly give uniformly good results. Will Mr. Davis be kind enough to state in your next issue what is the rate of flow due to a head of, say, 8 inches through a given thickness of material and what that due to a head of 80 inches through the same stratum.

I am led to make these inquiries, as Mr. Hazen, in a recent article in the *New York Engineering Record*, published a tabular statement for mechanical filtration for some twenty-eight cities, differing in population from 5,000 to 300,000, and from which I have calculated the ratio of filtration per square foot of filtering bed or area to differ by from 1 in 5 to 1 in 60 of the population, which would seem to indicate in some cases too small a velocity to insure an adequate supply, or too great a velocity to allow of proper quality. A communication of mine in the premises, followed by an answer of Mr. Hazen, appeared in the last issue of the same journal, to which I beg to refer Mr. Davis as further illustrative of the result I desire to arrive at, as Quebec is just now agitating the question of filtering its ten million gallons daily supply of water, and may find it advisable to see as to which is the preferable of the two systems; the supposed-to-be comparatively slow process of European filtering through extended areas, or the quicker mechanical American process through lesser areas.

I would also ask Mr. Davis for an approximately accurate interpretation of what is meant at the beginning of his last paragraph, page 396, by the words, "The aluminum sulphate in solution is added in *small amounts* to the water as it flows to the settling basin." Will Mr. Davis please state what ratio or percentage this *small amount* should bear to the quantity of water, or is this to be arrived at by experiment, and as due to the greater or less turbidity of the water?

Mr. Davis may be assured that his answers to these questions will be highly appreciated by the readers of this valuable medium of information, MUNICIPAL ENGINEERING.

C. Baillairge, C. E., Quebec.

This question was referred to Mr. Davis, and his reply, on account of miscarriage by mail, was received too late for the January number. It is now presented, as follows:

"I have read with much interest the letter of Mr. C. Baillairge, C. E., of Quebec, requesting additional information on a few points concerning the English filtering system, which were not mentioned in your December issue. The rate of filtration in an English system depends on the size and character of the sand particles, the loss of head, the temperature of the water, the thickness of the filter and the condition of the bed as to its accumulated impurities. When the filter is clean, the velocity of flow varies directly as the square of the size of the sand particles and the loss of head, and it also bears a direct functional relation to the temperature of the water; but it varies indirectly as the thickness of the filter. When the bed is clean and operated under perfect conditions a loss of eighty inches head produces ten times the amount of water that a loss of eight inches will produce. This relation, however, only holds good for a very short time after beginning filtration, owing to the accumulation of bacterial jelly and impurities found on the sand particles.

"Mechanical filters that give satisfactory results are generally operated with a coagulant. Aluminum sulphate is commonly used for this purpose, and its amount depends largely upon the soluble organic matter and biological impurities to be removed. The

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exact quantity of this that should be used can only be determined by experiment, but it usually ranges from a fraction of a grain to several grains per gallon of the water, and a turbid water requires more coagulant than a clear one. A solution of this agent is added automatically to the water as it passes to the filter, and when sufficient time is given for its proper action, the work is done in a perfect manner. To effect this change requires the presence of a basic substance, like carbonate of lime or magnesia, in solution in the water, to decompose the sulphate of aluminum. Most waters contain enough of these for that purpose. The sulphuric acid of the coagulant unites with the lime and magnesia, while the alumina is converted into a flocculent hydrate. This being formed throughout the whole mass of water, seizes onto and coagulates the albuminous matter in much the same manner that alum or an acid coagulates the albumen of an egg when added to it; and at the same time the organic coloring matter of the water is absorbed by the mordant.

"As this chemical change takes place in the water, the coagulated material entraps the bacteria so perfectly that it is an easy matter to render water nearly sterile. But to do so requires the most careful supervision of the use of the coagulant and the mechanical operation and management of the filters. At first, after washing the filters, the effluent water is necessarily more impure than it is after they have been used for some time. This is because at first there is no gelatinous bed formed to catch the coagulated impurities, but as this is gathered, it entraps more perfectly the various constituents from the water, including the hydrate of alumina, until the filters become clogged to so great an extent that they are practically inoperative. To manage filters properly requires judgment as well as scientific skill, and they can be made to give entire satisfaction only when washed frequently and controlled in accordance with the character of the salts and impurities of the water. Every filtering plant should, therefore, have a bureau of inspection of its own, and the operation of the filters should be controlled by chemical, microscopical and bacteriological tests."

Other matter called for by Mr. Baillairge will be found already answered in an article on "Mechanical Filtration" in the January number, and one on "Selecting a System of Purification" in this number of this magazine.

WATER MOTOR FOR PUMPING.

Can we find a hydraulic ram which pumps one kind of water and uses another kind as motive power? *Ladshaw & Ladshaw,*
Spartanburg, S. C.

This makes the machine a water motor rather than a hydraulic ram, and probably the simplest combination for such work, if the supply of motor water is sufficient, is a water motor running a pump of desired capacity and strength to raise the water to be supplied to the required height. Some manufacturers of such machinery are represented in our advertising columns.

CITIES HAVING BOARDS OF PUBLIC WORKS.

I wish a list of cities having boards of public works, as we are considering the establishment of such a board in this city. *E. H. Towne,*
City Clerk, Worcester, Mass.

The following may be mentioned as cities having boards of public works, variously constituted, whose experience will be of value in framing a plan for such a board in Worcester: Hartford and New Haven, Conn.; Newark, N. J.; Rochester, N. Y.; Columbus and Cincinnati, Ohio; Indianapolis and Fort Wayne, Ind.; Peoria, Ill.; Detroit and Grand Rapids, Mich.; Davenport, Iowa; Omaha, Neb.; Kansas City, Mo.; Denver, Colo.

CEMENT SIDEWALKS.

The question of laying cement walks is at present being discussed by the board of aldermen, and anything bearing on this subject will be acceptable.
B. A. Littell, Mayor, Opelousas, La.

Several articles of much interest will be found in Vol. XIX, July–Dec., 1900. "Specifications (Pittsburg) for Portland Cement Sidewalks," pp. 16, 86; "Cement Streets in Bellefontaine," p. 427; "Checking of Cement Sidewalks and How to Prevent Cracking," pp. 23 and 24.

"The Directory of American Cement Industries and Hand-book for Cement Users," now in preparation for early publication, will give information and specifications for good work.

METHODS OF LEVYING ASSESSMENTS.

Can you tell me if there is any report, article or publication which will give the methods of levying special assessments in a number of cities sufficiently large to enable one to form a general idea of what is the best practice?
Irvine Watson, City Engineer,
Traverse City, Mich.

The reports of the committee on taxation and assessment of the American Society of

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Municipal Improvements are valuable literature on this subject, especially that in the report of the third convention, October, 1896. D. L. Fulton, secretary of the society, Allegheny, Pa., can furnish the volume.

A glance over the tables of contents of the volumes of MUNICIPAL ENGINEERING magazine will show a number of valuable articles. There are several in the volume ending December, 1900, some applying directly to Michigan conditions and laws.

BOOKS ON HIGHWAY BRIDGE CONSTRUCTION.

I am anxious to purchase a book treating of highway bridges, wood and combination, with plans, elevations and details for spans of 50 to 150 feet, of different designs. *J. C. White, Baker City, Ore.*

Wood's "Treatise on the Theory of Construction of Bridges and Roofs" ($2) treats of all the well-known forms of bridges and is illustrated with numerous wood engravings. Boller's "Practical Treatise on the Construction of Iron Highway Bridges" ($2) is an old book and a good one, written for town committees and therefore not highly technical. It is well illustrated but not applicable in details of construction to wooden structures. Foster's "Wooden Trestle Bridges" ($5) has some treatment of short spans and of trestles. Waddell's "De Pontibus" ($3) is a new book, somewhat more technical, but still intended in part for county commissioners. It treats of steel bridges, with chapters on combination bridges and trestles. Merriman's "Bridge Design" ($2.50) is intended for the engineer and the student.

MACADAM OR BRICK PAVEMENT FOR SMALL CITY.

Is macadam regarded as a good pavement for a city of 7,000, or should brick be used?

Herman Munk.

The question of choice of material for streets in such a city is determined in part by the relative cost of the materials as well as by the relative cost of maintenance and the considerations of sanitary condition, noise, etc. In Indiana, where the questioner lives, macadam is not usually too expensive as compared with its value in relation to other materials. This is not, therefore, of much importance. A few blocks of street on which business houses face, a few alleys in the rear of such buildings, a very few streets running from the business center or large factories to the freight stations of the railroads, may have enough traffic to make it rather too difficult and expensive to keep a macadam pavement in repair, the mud cleaned off and the dust laid. It will be economical and more convenient to pave such streets and alleys with some harder material, such as brick or asphalt.

There may be one or two residence streets also whose residents are able and willing to pay for the harder pavement, but most of the residence streets of the town can scarcely afford the greater cost of the harder pavement. For them macadam is required on account of the cost. There are other arguments which often turn the scale in favor of macadam when the residents on the street are evenly divided, or nearly so. Thus macadam is more nearly noiseless; if well kept, it is quite as agreeable to look at; it is easier upon horses. In a small city all of these arguments are of much weight, while the arguments of heavy traffic, cleanliness and frequent need of repair which are potent in favor of the harder pavements in large cities lose their force in cities of this size, because, with the exceptions noted, the traffic is not heavy enough to wear the road rapidly and it is therefore durable and easy to keep clean.

Please explain how it is that ceiling battens can be seen through the plastering, even after it has received two or three coats of whitening. At the Basilica here we can disagreeably see all the centering through the plastering and the two coats of paint lately given it. At the St. Bach's church here we can too plainly see all the centering through the seven-eighths-inch pine lining and three coats—in fact, five coats—of paint. How is this?

Chas. Baillairge, C. E., Quebec.

The writer has always assumed that this phenomenon was explained by the easier passage of dust-laden air through the more porous parts of plastering or ceiling, thus producing by deposit of the dust a discoloration which appears the more quickly the greater the difference in the porosity. If this does not agree with the observation of our correspondent or our readers we shall be glad to hear from them.

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VITRIFIED PIPE CONDUIT, HARTFORD WATERWORKS.*

By W. E. Johnson, Superintendent, Hartford, Conn.

During the fall of 1899 the Water Commission of Hartford decided that some step must be taken to prevent the loss of water from the canal connecting reservoir No. 6 with the distributing system. Two plans were considered, viz.: that of lining the canal with some impervious material, and that of laying a line of pipe connecting reservoir No. 6 with the lower reservoirs.

A somewhat lengthy investigation of both plans ended in a decision in favor of a 24-inch vitrified pipe conduit. Two routes for the pipe line suggested themselves. In the one the pipe was to be laid in the bed of the canal with a grade of 6-10 of a foot per 100 feet, this being the grade of the canal. The other route considered and finally adopted was somewhat longer than the first and planned to utilize the entire fall of 50 feet between the effluent pipe of reservoir No. 6 and the flow line of reservoir No. 5, the length of this line being 16,700 feet and the grade 2.98 feet per 1,000 feet. A very detailed specification for kind and quality of the pipe required for the conduit was used.

Two inspections of the pipe were made, one at the time of unloading from cars in Hartford and another as the pipe was about to be laid in the trench. Duplicate blank forms for each car load were furnished the inspector, which he filled in with the result of his inspection and returned to the engineer as each car was emptied.

The pipe line, traveling as it does the side

*From a paper read before the Connecticut Civil Engineers and Surveyors' Association.

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of Talcott mountain, is entirely through private property, mostly wood and pasture land, through which a right of way twenty-five feet in width was secured. The extremely rough and uneven condition of the hillside, together with the apparently large amount of solid rock to be encountered, necessitated the making of a topographical map of the proposed route, it having been decided that the minimum covering over the pipe should be three feet. From this map was planned and laid out the line for the conduit as afterward built.

To avoid as far as practicable sharp bends and at the same time to shorten the line as much as possible, the conduit at several places is laid upon embankments built for the purpose. At one point the conduit intersects at right angles a valley through which passes a highway; to avoid a long detour into the valley, with several sharp bends and a large amount of rock excavation, the pipe at this point was, for a distance of 300 feet, dropped below the otherwise uniform grade maintained throughout the line; the lowest point in the depression being 9.65 feet below the established grade. Here the conduit is carried over a small stream, three lengths of cast iron pipe supported on concrete piers being used.

The alignment of the conduit is made up of arcs of circles and of tangents; of the latter, the rolling nature of the ground allowed but few of any considerable length. It was possible to secure long radii for most of the curves, but a few were laid with radii about 175 feet in length.

The trench had a bottom width of 4½ feet, no further excavation for bell holes at the sides of the trench being necessary. The bottom of the trench was excavated (but without special care) slightly below the grade of the pipe. The grade and alignment for the pipe was obtained from a line of stakes driven in the bottom of the trench one every 12½ feet. At intervals or three feet spruce blocks 2x4x15 inches were thoroughly imbedded in the bottom of the trench, and at the same time the top of each was brought to the required grade. This was accomplished by means of a cord stretched from one grade stake to the next. As the weight of each pipe was approximately 540 pounds, a light pipe derrick was used for lowering them to their position on the spruce blocks. The alignment between the grade stakes was trusted to the man in charge. The pipe being placed in position, its inner circumference was centered with the preceding pipe and temporarily held in place by means of two hard wood wedges; the gasket having been cut into lengths sufficient to make one turn around the pipe, was worked back to the bottom of the bell in the usual manner, and the wedges were removed. The outer surface of the spigot end and the inside of the socket were corrugated or furrowed, the object being to secure a larger amount of surface and consequently a better bond. The joints were filled with a mixture of equal parts of American Portland cement (Alpha brand) and clean sharp sand; as little water being used as possible. The cement was worked into the joints by means of rammers having a face 4 inches long and 5-16-inch wide, and which were slightly curved to conform with the shape of the bell. The space at the ends of the bells was filled with cement, the finished surface forming apparently an angle of 45 degrees with the surface of the pipe.

The back filling was deferred until the cement had thoroughly set and a final inspection of the joints had been made. All openings or unevenness at the joints on the inside of the conduit were thoroughly filled with cement, thus securing one continuous smooth surface. Special attention was paid to the back filling under and around the pipe, tamping bars similar to those used in track work being principally used; the filling being carried to the top of the pipe and all thoroughly rammed. In this condition the trench was left until laying was completed and the line put to its ultimate use.

At the foot of the slope at reservoir No. 6 a well was built, and with this the 20-inch pipe leading from the reservoir and the 24-inch conduit were connected; the well is of concrete, eight feet in diameter and nine feet in depth, the connection between the well and conduit being a 30-inch by 24-inch reducer. The depth of the water in the well is controlled by means of a gate valve placed on the 20-inch pipe. The length and grade of the conduit being as given, its carrying capacity was calculated to be 8,600,000 gallons per day (n equals .012), without running under a head.

For a period of thirty days the drop in reservoir No. 6 and the rise in the lower reservoirs were carefully noted, and other factors entering into the calculation considered. These figures would indicate that the conduit was discharging about 9,750,000 gallons per day.

The work was done by the water board; the cost of the pipe line not including excavation and refilling trench was $1.49¾ per foot.

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CURRENT INFORMATION.

Large Electric Plant of Brooklyn Rapid Transit Company.

The Brooklyn rapid transit company will install in the borough of Brooklyn one of the largest electric motor plants in the United States. A power house will be erected, adjoining the present power house, the cost of which, including the equipment, will approximate $3,000,000. The chief feature of the equipment will be a 24,000 horse-power motor plant. The contract for the six new engines of 4,000 horse-power each has been awarded to the Westinghouse electric and manufacturing company at a figure approximating $500,000.

Does Lighting Contract in Cincinnati Rule Out Experimental Lights.

An opinion has been rendered by Corporation Counsel Hunt to the board of public service, Cincinnati, on the right of the board to direct the placing of an incandescent light in some one of the electric lighting districts of the city. A resolution was passed by the board of legislation directing the placing of an incandescent gas light on McMillan-st., between Cleinview and Forest-aves. When the resolution came before the board of public service the opinion of Counsel Hunt was asked, who says: "Although the erection of this incandescent gas light is in an electric lighting district, you can establish such light if it does not come within the restrictions of the ordinance, No. 453, passed Feb. 3, 1893. That ordinance provides that when any street, alley, etc., is lighted by electricity under the contract with the Edison company of March 31, 1892, then all other lighting at the expense of the city of such streets, etc., 'in proximity' to electric lights erected by the said company shall be discontinued."

New York Electric Lights to Be Hung Nine Feet Above the Sidewalk.

Ordinances have been approved by the board of public improvements of New York City making it a punishable offense to hang electric lights in front of stores less than nine feet above the sidewalk. President Grout of the borough of Brooklyn is of the opinion that all lights should be taken from sidewalks, as they are dangerous to passers because of the possible breaking of wires.

Contest Between Mayor and Council in South Milwaukee.

The Hon. F. E. Mansfield, mayor of South Milwaukee, was removed from office by impeachment proceedings, Dec. 28. The removal was the result of a contest between the common council and Mayor Mansfield which originated in the negotiations for the sale of the South Milwaukee electric and power plant to the city for $27,000. A resolution passed by the council in September was vetoed by Mayor Mansfield, because he believed the price exorbitant. During his absence from the city the council passed the resolution over his veto, and the acting mayor signed it. On his return Mayor Mansfield refused to sign orders to pay operating expenses. These orders were then signed by one of the council, but the city treasurer refused to honor them. The city council then decided to impeach Mayor Mansfield on five counts. Of these the first two specified that he refused to sign orders for $107.92 and $94.34 respectively; the third alleged that he counseled the city treasurer to refrain from collecting debts due the city for electric lights furnished inhabitants; the fourth alleges that he refused to sign all orders for claims for operating the electric plant; the fifth finding claims that the electric light plant was shut down and the city is left in darkness by reason of the said acts of the mayor. Mayor Mansfield has taken the matters to the courts where the entire proceeding will be reviewed. The action of the council is exceptional, and it is believed that the court can revise the action of the council.

Conduit for Electric Wires for Duluth

Plans for a conduit under Michigan-st., Duluth, Minn., have been completed by City Engineer McGilvray. The conduit, which is for the accommodation of the electric light, telegraph and telephone wires, will occupy 33x33 ins. of space and be 18 ins. below the paving, and will have 20 ducts. The conduit is divided into two sections, one for high tension electric light cables and the other for low tension cables, like the telegraph and telephone. A 6 in. concrete wall will be placed between the sections and each duct will be separated by 3 ins. of concrete.

A Metallic Cement for Wire Joints.

A formula for a metallic cement, to be applied, without the use of heat, to wire joints by hand after the wires are twisted together, and for practical purposes taking the place of solder, is given in the American Manufacturer, as follows: "The cement is an amalgam with which a binding material is mixed so that the mass has the consistency of putty. When put up in stick form it is said not to harden except at the surface, where a crust is formed, and when the mass is worked in the fingers it becomes soft and plastic so as to be readily applied to the wires. The following ingredients are used in the proportions specified: Zinc, four parts; tin, two parts; copper, two parts; cadmium, two parts;

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bismuth, four parts; lead, two parts; antimony, one part; mercury, eight parts. The solid metals are granulated and melted together, after which the mercury is added, the mass being stirred at the same time. When cooled, it is pulverized in a mortar and the binding material, consisting of liquid glucose or sirup and silicate of soda, is added in quantities sufficient to give it the consistency of putty. When spread out on a joint it is said to adhere tightly and to harden in twenty-four hours. No application of acid to the wires is necessary, and it is stated that the joint is well protected by the amalgam from oxidation. It should be taped in the usual way."

Suit on Infringement of Tesla Patent.

Suit has been filed in the United States circuit court at Cincinnati, O., by the Westinghouse electric and manufacturing company, alleging that the Bullock electric manufacturing company has infringed their rights in an electro-magnetic motor invented by Nikola Tesla on Oct. 12, 1887, and patented Jan. 28, 1888. A half interest was transferred to Charles F. Peck of Englewood, N. J., and later the patent was transferred by the two holders to the Tesla Electric company, and by that firm to the Westinghouse company. It is alleged that, in spite of warning, the defendant firm persists in the use of the patented infringement. The Westinghouse electric and manufacturing company succeeded on Nov. 5, 1900, in securing an injunction in New Haven, Conn., against the New England granite company and J. G. Patterson for similar infringement.

Acetylene Gas Lighting in Germany.

At the second annual congress of the German acetylene verein, held at Dusseldorf recently, a prize of $250 was offered for the best design of a table lamp to burn acetylene gas. A similar sum was immediately added by the carbide manufacturers. Several papers were read during the congress showing the extent of the use of acetylene gas, which seems to be more popular in Germany than elsewhere. Information as to its desirability was obtained from more than twenty German villages where it is used for public lighting, and they unanimously reported perfect satisfaction. No accident of any kind had occurred, and there had never been any interruption of service. It is used for cooking purposes in five of these towns, and at Ellerbak it is supplied at a special price for driving engines. A demonstration was made at Dusseldorf, by lighting the town halls and buildings in the neighborhood with ordinary illuminating gas, and the gardens with 800 acetylene burners, giving a total light of 40,000 c. p. The greater brilliancy of acetylene was successfully demonstrated. It is used in a number of passenger stations, a freight station at Hamline, and in the Polegate station in Sussex, England.

New Albany, Ind., Sustained in Breaking Gas Lighting Contract.

The Indiana Supreme Court handed down an opinion Jan. 8 affirming the decision of the trial court in the case of the Gaslight & Coke company vs. the City of New Albany. The appellee had granted the gas company a 20-year franchise in 1871, with a provision for extending it another 20 years in case the city did not elect to buy the gas plant at the expiration of the first term. After 17 years, however, a new contract was made by which the company agreed to furnish gas for a large number of street lamps at $1.50 per thousand feet, and to furnish it to private consumers at a slightly increased rate, and the city undertook to maintain the agreed number of lamps for 23 years. A new council was elected and provision was made for lighting the streets by electricity. The company sued for damages. The lower court decided against the company and the Supreme Court affirmed the decision.

Peoria Gas Rates in Court.

Judge Thomas M. Shaw, in circuit court, Peoria, Ill., rendered an opinion, orally, Nov. 10, 1900, in the case of the People vs. Peoria Gaslight and Coke company, of which the following gives the principal points interesting to our readers:

The first count sets forth the information that the Peoria Gaslight and Coke company has been using without legal warrant certain liberties, privileges and franchises. A demurrer to this count for indefiniteness in the description of the company and its method of incorporation is sustained. The second count asserts that the gas company charged 85 cents for gas used for fuel and $1.25 for gas used for light, though the same gas was furnished. The third count states that recently the company has charged some of its customers 30 cents, some 50 cents and some $1.25 for the same gas, and that 50 cents is a reasonable charge. The fourth count sets forth that on or about July 31, 1900, the Peoria Gaslight and Coke company entered into an agreement with the Peoria Gas and Electric company, with which it had been in active competition in some portions of the city, whereby the price of gas for illuminating purposes is set at $1.25. Relief is asked on the ground that the difference in rates for different purposes, as in the second count, or to different consumers, as in the third count, is illegal; and that the combination alleged in the fourth count to raise the price to the highest price ever charged is also illegal, and that 30 cents is a reasonable price for gas.

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Demurrers to the second, third and fourth counts were overruled.

Quarter-in-the-Slot Gas Meters in Spokane Falls.

A number of automatic gas meters have been purchased by the Spokane Falls Gaslight company of Spokane, Wash., according to local press reports, by which a patron can purchase just as much gas as he wishes without having a bill presented, or without going to the office to have a man come around and read the meter. The machine is made in England, and is so constructed that the purchaser puts 25 cents into it, or as many quarters as he desires, turns a lever, and the gas flows to the amount paid for. The machine is so arranged that the gas burns low just before going out, thus giving sufficient warning. The rate is a little higher by this method, as a quarter purchases about 110 cubic feet, which makes the rate about $2.25 per 1,000 cubic feet.

Hyde Park, Chicago, Gas Rate Must Remain at 72 Cents.

Judge Gunn of Chicago granted a temporary injunction, Jan. 5, restraining the People's Gaslight and Coke company from charging more than 72 cents a thousand cubic feet for gas furnished for heating purposes in Hyde Park. Judge Gunn holds that the People's Gaslight and Coke company is bound by the obligations of the Mutual Gas company, its predecessor, in supplying gas to Hyde Park residents, and must therefore furnish the gas for heating purposes at a price not to exceed 72 cents a thousand cubic feet. The People's Gaslight company charged the rate for several years in Hyde Park, but when suit was brought to compel the company to supply gas to all its patrons at the same rate, the company raised the price of gas in Hyde Park to the $1.00 rate. This action on the part of the company was followed by injunction proceedings instituted by Frederick C. Hale.

In his decision Judge Gunn first gave an exhaustive review of the situation in the gas business in the years prior to the annexation of Hyde Park and later after the consolidation of the Chicago companies had been effected. He referred to the consolidation of the gas companies, and cited that since such consolidation the company, up to Dec. 5, 1900, or for a period of nearly three years, has been furnishing gas to the residents of the former village of Hyde Park at 72 cents; that on Dec. 5, 1900, it notified its customers in said territory that thereafter it would cease to suppy gas at 72 cents, and would charge them $1.00 per thousand cubic feet for all illuminating gas furnished, irrespective of the use made thereof. In conclusion he says:

The defendant company is authorized to sell gas for heating or fuel purposes in Hyde Park only by virtue of the gas company consolidation act. As before stated the Mutual Fuel Gas company, which it acquired, ordinance to furnish, and it had been for years furnishing to residents of Hyde Park, gas for heating purposes for 72 cents. By virtue of the provisions of Section 9 it therefore became the duty of the consolidated was compelled by the Hawk and McClary People's company to furnish to the residents of Hyde Park gas for heating purposes at the same price unless it has obtained otherwise the right to charge more.

The case will be carried to the appellate court. This is the first judicial ruling in the gas war to follow the hearing of arguments, and it is regarded as a great victory.

Heretofore injunctions and stipulations have been entered without strenuous argument.

Obstruction to Increase in Santa Rosa Water Supply Removed.

A decision was rendered in the Superior court, at Santa Rosa, Cal., Dec. 29, in the condemnation proceedings recently instituted by that city against the Fountain water company for possession of the property known as Peters's spring. The decision was entirely in favor of the city. The spring, together with ten acres of land and a right-of-way from the county road to the spring land, is located a short distance from the city's water works and pumping plant. The city's supply has not been as abundant as the city officials desire, and they endeavored to purchase this property, time and again, at some reasonable figure, but to no avail. The minimum price of the Fountain water company was $75,000. The jury placed the actual value of the land at $400 an acre, or $4,000 for the property. The case will probably be appealed.

Water Meters and Duplicate Pumping Engine Recommended for Rockford, Ill.

The report of Willis M. Kimball, superintendent of the water department at Rockford, Ill., calls attention to the need of improvements in the water works system which will prevent the crippling of the plant through accidents. He says the water department has 270 water meters in service, and the results gained by their installation in stopping wasteful practices, in discovering leaking pipes and fixtures, and in regulating absurd flat rates has more and more justified the wisdom and justice of their use. He recommends that meters be placed as rapidly as possible in the future until all factories, stores, flats, business houses and residences having sewer connections and using water are supplied with this method of measuring and selling city water. He

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recommends the purchase of a new modern pumping engine of 7,000,000 to 8,000,000 gallons daily capacity. He says that a proposed self-contained electric light plant, to be stationed at the water works, the construction of a river drive and probably a public library are among the contemplated improvements which are being investigated.

Commission of Engineers to Report on Water Filtration for Washington.

An informal hearing was given Jan. 4, at Waldorf-Astoria, New York City, before the committee of the senate on the District of Columbia which is investigating the respective merits of the mechanical and the slow sand systems of water filtration. Dr. J. S. Billings, John W. Hill, Allen Hazen, Rudolph Hering, G. W. Fuller, W. P. Mason, Edmund B. Weston, Dr. William C. Woodward and Col. Miller were among the number of witnesses who testified regarding the two systems, and some difference of opinion developed. It was decided that before reaching a final conclusion as to which method shall be used for Washington, further data should be obtained. Messrs. Hazen, Hering and Fuller were appointed a commission to make a careful study of the filtration problem in the district and report its conclusions as to the best method of filtering Potomac water to the committee of the senate. It is believed that a report will be made in time to be acted upon at this session of congress.

Decree in Ogden, Utah, Water Works Case.

A decree was signed by Judge Hiles, Jan. 4, in the case of Ogden City, Utah, vs. Bear River Irrigation & Ogden Waterworks company, giving to Ogden City the sum of $266,443.91. The decision of Judge Hiles, rendered May 18, 1898, and the finding of the master of chancery in December, 1900, ordered by Judge Hiles, were given in the January, 1901, number of Municipal Engineering Magazine.

The Proposed Ramapo Water Supply for New York Attacked in Legislature.

A vigorous attack was made upon the Ramapo water scheme when the New York legislature convened recently. S. Fred Nixon, speaker of the lower house, said:

The subject of an adequate water supply for the great city of New York is one of the important matters that has occupied public attention for over a year past, and it should be permanently settled at this session that the city shall own its own supply, and if any corporation has acquired powers that might prevent any city or village in the state from owning its source of water supply the charter of that corporation should be repealed and the people protected in their right to municipal ownership.

Later a bill was introduced in the senate for the repeal of the Ramapo company's charter. In his inaugural address Governor Odell said:

The ownership of water rights sufficient to provide the city of New York with an ample supply of pure and wholesome water should be entirely under the control and direction of that municipality. By what now seems to have been an unfortunate omission in the original charter of the city of New York, the city is not given the same rights that are afforded other municipalities for securing an additional water supply.

Contract for Hydrant Rental Beyond City Limit of Indebtedness Declared Void in Montana.

The Montana supreme court rendered a decision recently in the appeal of the Helena Water Works company from the decision of Judge McIntire in the district court. The Helena Water Works company applied for a mandamus compelling the city of Helena to audit and pay the bills for water supplied under the contract of 1897. The decision holds the contract illegal because under it the city incurred a debt when its debt already exceeded the constitutional limit and declares illegal all debt contracted under the contract, thus releasing the city from an obligation amounting to $30,000 with interest, which has accumulated during the last three years. The contract in question was made in accordance with an ordinance passed Aug. 17, 1897, providing that the city should pay the company for water $1,500 a month and $5.85 a month for each additional hydrant ordered, for five years from Aug. 1, 1897. The ordinance also provided that the council should annul taxes under the provisions of the political code of the state of Montana authorizing the levy of taxes for general purposes sufficient in amount to meet the appropriations thereby made. A tax was levied for the purpose for each fiscal year down to and including 1900. When the present mayor took the office in May, 1898, he took the position that the contract was illegal because no bids were advertised for, as required by the city ordinance; also that at the time the contract was made the city debt was in excess of the legal limit of 3 per cent., which was at most $516,000. The term "indebtedness," as used in the city charter, is interpreted by Judge Wood, who exhaustively reviews the decisions of Iowa, Illinois and Indiana, wherein the meaning of constitutional provisions, practically the same as that of sec. 6 of art. 13 of the constitution of Montana, is determined, and reaches the conclusion that the contract before the court in which a liability to pay money on a contingency morally sure to take place, irrespective of any action taken or option exercised by the city in the future, constitutes an indebtedness such as is prohibited by the express terms of the charter.

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This decision is final, and no appeal can be taken. The only recourse open to the company is to agree with the council on a monthly rate or bring suit for reasonable value of the water and let a jury decide how much that shall be.

Ft. Madison Must Pay Rental for Fire Hydrants Too Liberally Ordered.

A decision was handed down by Judge McPherson of the federal court, Dec. 18, in the water works case at Ft. Madison, Ia., which supports all the contentions of the water works company and compels the city of Ft. Madison to raise by taxation the money to pay the demands of the company. The suit was the outgrowth of conditions in Ft. Madison following the ordering of hydrants by the city council. In its contract with the Ft. Madison Water Works company, made May 24, 1885, the city agreed to take fifty-one hydrants at $75 per year rental for the first forty hydrants, and $60 per year rental for each one over forty. The contract provided that the city might order in additional hydrants as it saw fit, and was to extend for twenty years, or until 1905. During a boom the city ordered hydrants liberally, until there are now 138 fire hydrants under the original contract at a rental which makes a total of $8,800, payable quarterly. The city council, finding that the city was overstocked with fire hydrants and that to pay the bills is onerous on the taxpayers, failed to pay a quarter's rental to the water works company to test the matter. The water works company brought suit in the federal court, with the result that the city will have to pay the company for the six months' fire hydrant rental unpaid and interest from the time it was due, and must continue to pay the $8,800 for five years longer.

A Water and Forest Commission Proposed for California.

At the annual meeting of the California Water and Forest Society held in San Francisco Dec. 13 and 14, arrangements were made for creating a commission to study the subject during the next two years and prepare a complete system of water and forest laws to be submitted to the legislature in 1908. The legislature, in the meantime, is asked to provide funds to continue the investigation in collaboration with the proper departments of the general government.

Park Commission Proposed for Rochester, N. Y.

Hon. George A. Carnahan, mayor of Rochester, N. Y., in his annual message favors the reorganization of the park department, and concurs with the opinion of Dr. Moore, president of the park commission, that better results can be obtained for the city's parks by vesting the management thereof in a committee of citizens rather than in a single official. He suggests the enactment of legislation providing for a park commission of five members, all of whom, except the president, shall serve without compensation.

Corporations with County Franchises Subject to City Laws Within Its Limits.

The Missouri supreme court handed down a decision Jan. 19, holding that corporations under county franchises are subject to city laws also. The opinion was given in the suit between Kansas City and the Kansas City Belt railway, regarding the construction, by the company, of bridges over its tracks in certain portions of the city. While foreman of the Metropolitan company six years ago, John Mulholland was arrested and fined because his gang of workmen excavated in the street of Westport, which at that time was not a part of Kansas City, without a permit as required. The company contended that the work was being done under a franchise granted by the county court before the limits of Westport were extended to take in the street in question. This contention was not sustained, and when appealed to the supreme court Judge Valliant decided that it should go back to the criminal court, and that the fine must be paid.

Proposed Street Railway Franchise in Columbus, O.

The granting of a twenty-five-year blanket franchise to the Columbus Railway company on all the streets in Columbus, O., now occupied by its lines, was recommended to the council by the board of public works Jan. 14. The ordinance provides that for the first ten years the company must require 5-cent cash fares, six tickets for 25 cents, with transfers, seven tickets for 25 cents without transfers, and 10-cent cash fares on owl cars. During the remainder of the life of the franchise the company must sell seven tickets for 25 cents with transfers, and charge only 5 cents on owl cars. No cash compensation to the city is provided. The ordinance has passed its first reading.

The Washington Memorial Bridge Bill.

A bill was introduced in the senate Jan. 3 by Senator Hawley, to create a memorial bridge commission of ten persons. The bill provides that the commission shall select for execution one of the two designs submitted to the senate committee in the District of Columbia. One of the designs was recommended by the board of engineers of the army, and the other was prepared by George Keller of Hartford, Conn. The architect and engineer whose design may be adopted will be placed in charge of the con-

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struction of the bridge and its approaches, subject to the general supervision and approval of an officer to be appointed by the commission to be created by the bill. The chairmen of the senate and house district committees are to be ex-officio members of the commission to be created.

Comprehensive Agreement Between Labor Unions and Bridge Companies.

An agreement was signed at Buffalo, N. Y., Jan. 5, between the Building Trades council and representatives of the American Bridge company, the terms of which provide that the bridge company will employ none but union men and will pay the prevailing rate of wages with time and a half for overtime. Any questions that may arise between employer and employe are to be submitted to arbitration. The agreement covers all iron work to be built at Buffalo, Niagara Falls, Lockport, Tonawanda, the Stony Point Steel plant and contiguous territory. It is one of the most sweeping agreements made in labor circles for some time and was the result of long conferences betweeen the interested parties, whose aim was to reach an understanding that would make strikes impossible in the bridge and structural workers' trades.

Railroads Must Replace Chicago Viaducts by Subways When Tracks Are Elevated.

A new ruling in track elevation was announced in an opinion given by Corporation Counsel Walker of Chicago, Jan. 18, who holds that viaducts may be replaced by subways in connection with track elevation, even though the city has, in the first instance, ordered the erection of viaducts. He holds that if the tearing down of a viaduct involves the question of the abolition of grade crossings on the same railroad line, then the city can compel a subway to be built. The opinion was brought out by a controversy between the city and the Chicago, Burlington & Quincy Railroad company over the proposal for the elevation of the latter's tracks.

More Track Elevation in Chicago.

The elevation of the tracks of the Chicago & Alton, Atchison, Topeka & Santa Fe and the Chicago, Madison & Northern roads in Chicago will begin early in the spring. Contracts for the iron and steel work for subways and bridges along the route have been awarded to the American bridge company, and bids will be opened soon for the concrete and masonry work. The plans include twenty bridges and subways. The entire cost of the improvements, which is to be conducted jointly by a commission of the three companies, will be about $2,500,000. It will probably require a period of about two years to complete the work. The city council ordered the tracks elevated in 1897, and after much delay the roads decided to co-operate and make the improvement.

Streator, Ill., Must Pay for Bridge—Claim of Unlawful Combination Not a Successful Defense.

A decision was rendered in the United States district court, Jan. 11, by which the city of Streator, Ill., will have to pay the Lafayette Bridge company of Lafayette, Ind., the sum of $24,800 for a new bridge over the Vermillion river. The company secured the contract for the bridge in September, 1897, for $24,800. All of the other competitors asked $42,000. The bridge was completed in August, 1898. It was claimed an unlawful combination had been entered into by the Chicago Bridge and Iron company and ten other concerns, among them the Lafayette company, to bring the price up and allow one of them to get the contract. It was also charged that each bidder was required to give a bond of $10,000, which was instrumental in keeping other bidders away. It was charged by the defendant city that the aldermen of Streator were bribed by a representative of the bridge company to give the contract to that company. When the bridge was half finished a new board of aldermen was elected, the old ones being defeated, it was claimed, because of the scandal resulting from the bribery charges. The first trial was held in Ottawa, and the jury disagreed. The case was then taken to the United States district court, with the above result. The original suit was for $40,000, which included interest, etc., on the actual cost of the bridge. but the amount awarded was the contract price.

Cresoted Wooden Block Bridge Pavement in Toledo.

The Cherry-st. bridge over the Maumee river, Toledo, O., may be paved with Kreodone creosoted block by Garrigan Bros. of that city, who are the lowest bidders. The specifications for this paving provide for a Kreodone creosoted planking three inches thick on the bridge stringers, covered with the block pavement proper, which is composed of Kreodone cresoted, long leaf southern yellow pine blocks, four inches wide, four inches deep and five to ten inches long.

It is laid with the fibre vertical on an angle of twenty-five degrees with the curb. The joints are filled with sand and a Kreodone paving cement. The specifications provide that "after the blocks have been inspected and found satisfactory they shall be placed in an air chamber, where by means of superheated steam and the use of a vacuum pump, all the sap in the blocks shall be vaporized and the moisture in them removed. When the blocks are thoroughly dry and while the

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cylinder is under a vacuum of fifteen or twenty inches of mercury, Kreodone paving oil shall be admitted to the cylinder and pressure added until the blocks have absorbed ten pounds of oil per cubic foot of timber, and until the Kreodone paving oil shall have impregnated the timber throughout the entire thickness of the block." The contract was awarded at $2.50 a square yard for the block pavement, which, with the planking and other items added, brings the total cost up to $14,714.97.

The samples of the blocks on exhibition in the city engineer's office are similar to the creosoted blocks that have been laid in Indianapolis.

Confirmation of the contract has been delayed by a deficit of funds in the bridge department.

Proposed Standard Method of Conducting the Rattler Test for Paving Brick.

The Illinois Society of Civil Engineers and Surveyors has been studying the methods of testing paving brick for a number of years under the able leadership of Prof. A. N. Talbot of Champaign, who has done as much to give direction to the thought of engineers and brick manufacturers on the subject as any one.

The society has refused for some years to give any recommendation of a method of making the rattler test, believing that the matter was still too much of an experimental nature to warrant such formal action. This year, however, the committee on paving brick specifications of which Mr. Talbot is chairman, has presented a form for such tests which has satisfied the society of its substantial accuracy and value, and the society has given the method the sanction of its formal approval and recommendation that the engineers of the country make the method a part of the specifications on paving brick which they hereafter prepare. This portion of the report of the committee follows, and can be compared with the similar program prepared by the N. B. M. A. with profit. No standards to which brick must conform are prescribed, but simply the method of making the tests that the best bricks may be selected with certainty and the results may be compared with those of other experimenters.

1. Standard Rattler. The standard rattler shall be polygonal in cross-section, with 14 plane staves spaced one-fourth inch apart at their edges, and the interior shall be free from projections, offsets, roughness or obstructions. Rattlers having two staves more or less than the standard number may be used. The internal dimensions shall be 28 inches in diameter and 20 inches in length.

2. Standard Shot. A mixture of two sizes of shot will be used. The larger size will be about 2½ inches square and 4½ inches long and will weigh about 7½ pounds. The smaller size will be 1½ inches in each direction and will weigh about ⅞ pound. The shot shall be made of ordinary machinery cast iron, an all edges shall be made rounded to a radius of about ¼ inch. The individual shot shall be replaced by new pieces whenever they have lost one-tenth of their original weight. For the standard size of rattler the standard charge of shot shall consist of 75 pounds of large shot and 225 pounds of small shot.

3. Number and Condition of Brick. For the standard size of rattler, 12 paving bricks or nine paving blocks will constitute the number to be used in a single test, but two more or less than this number may be used. The bricks shall be thoroughly dried before testing.

4. The Test. The rattler shall be rotated at a rate of not less than 28 nor more than 30 revolutions per minute, and 1,800 revolutions shall constitute the standard test. The speed requirement is important.

5. The Results. The loss shall be calculated in percentages of the original weight of the dry brick composing the charge. In weighing the rattled brick, any piece weighing less than one-half pound shall be rejected.

6. Variations in Size of Rattler. Rattlers 28 inches in diameter and of a length greater than 20 inches may be used, in which case the charge of shot and the number of brick shall be increased proportionally to the increase of length. Rattlers of smaller diameter will give smaller losses, which cannot be accuratey compared with those obtained with the 28-inch diameter. However, if 24-inch or 26-inch rattlers are used, it is recommended that the charge of cast iron shot be equal in volume to 10 per cent. of the volume of the rattler, which is about 1 pound of shot to each 40 cubic inches of rattler volume. For a 24-inch machine the charge should be composed of half large size and half small size of shot, and for the 26-inch machine one-third large and two-thirds small size.

The Venezuelan Asphalt Controversy.

The developments of the past month in the controversy over asphalt concessions in Venezuela indicate that the difficulties arise from the possibility of executive action in that state upon such matters independently of the courts and the consequent contest over conflicting decisions. It is now expected that the contentions of the interested parties will be submitted in due form to the Venezuelan courts and decided by them according to their respective merits. This is the practice in the United States in such cases and will doubtless be satisfactory to both parties if it can be followed in Venezuela.

Repairs of Asphalt Pavements in Buffalo.

The recent report of F. V. E. Bardol, chief engineer of the board of public works, Buffalo, N. Y., regarding the condition of the asphalt pavements in that city, states that the criticisms made last summer arose primarily on account of the system formerly in force for paying for street repairing.

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Although this has been changed, Mr. Bardol believes that further amendments to the rule are desirable. During recent years communications have frequently been sent to the common council calling attention to the condition of the streets, and if prompt action had been taken on the receipt of these letters the opposition to improvements would not have been so strong because there would have been fewer streets to repair at any one time. As it was, the situation in Buffalo last summer was aggravated by the large number of streets reported as being in need of immediate repair. He says that criticisms have been made that streets are accepted in such poor condition that extensive repairs are necessary as soon as they pass under the control of the city. In order to show that this is an entirely erroneous assumption, Mr. Bardol quotes that on 84 streets whose guarantee expired in 1898, the total cost of repairs during 1899 was $1,127, or 7 mills per sq. yd.; of streets with guarantees expiring in 1897, 4 out of 45 needed repairs in 1898, and cost 7.7 mills per sq. yd.; and in 1899 13 streets were repaired at a cost of 2¼ mills per sq. yd.

When defects appear in asphalt pavement, the first charge made is poor asphalt. Mr. Bardol believes that this is usually due to ignorance, malice or prejudice; that the people who attribute the result to such causes have never given the subject serious thought. The durability of the pavement is controlled by other conditions, such as the manipulation of the material, the kind of sand, the foundation and its mode of construction, as much as the asphalt itself. Mr. Bardol says that with the clayey soil found in most parts of Buffalo it is practically impossible to replace the material in trenches so as to avoid subsequent settlement. The practice in that city has always been to order the pavement and then put in the necessary sewer and water connections during the time occupied with the paving proceedings. Notices are sent out to give the property-owners a chance to make their own connection. As a consequence, this work often falls into the hands of an unscrupulous plumber, with whom inspection means a man to watch every shovelful of backfilling to see that it is properly tamped.

In order to be sure that the work is properly done, as many inspectors are required, therefore, as there are excavations. Connections that are left out are put in by the paving contractor at a fixed price and guaranteed by him for the same period as the pavement. Of settlements required by the Barber asphalt paving company on streets lapsing from guarantee in 1898, 465 square yards were over its own connections and 16,699 square yards over trenches made by individuals and corporations. The remedy for this is for the city to control all street work by doing the work itself or having it done by some responsible party under a guarantee against settlement, and even then the streets should not be paved until the year following the work on the underground improvements.

In Buffalo, cracks, which are generally due to the contraction caused by cold, appear most frequently on streets having little or no traffic. It is believed that this is due to the fact that asphalt, being plastic, is kept free from cracking by the constant kneading produced by traffic. Absence of traffic tends to allow the asphalt to become more or less spongy or porous, owing to the changes in temperature. If a pavement cracks under heavy traffic, it is considered an indication that the asphalt cement is at fault, being deficient in bitumen and too hard for want of sufficient flux.

In the older Buffalo pavements waviness was due to the sliding of the mixture on the concrete, but this has been overcome to a large extent by the use of the binder course, which was introduced for the purpose of remedying this particular defect. Mr. Bardol states that shoves or ridges, usually extending from the curb toward the center, are caused by the swelling of the cement used in the concrete, and are due to defects in manufacture from the following causes: Faulty components of the raw material, imperfect preparation of the raw material, imperfect burning, and too high a percentage of sulphur or magnesia.

Swelling, due to much lime, shows itself in a very short time. He also states that disintegration in spots is due to various causes, which are classified as follows: Material of an inferior quality, improper proportion of mixture, careless manipulation, a poor foundation and bad drainage.

According to Mr. Bardol the value of an asphalt depends on the amount of bitumen it contains, provided, of course, that the bitumen meets the proper test. It would seem that the deposit having the least percentage of foreign substances would give the most uniformly satisfactory results, but it does not follow from this that, because a deposit is more or less impure, these imperfections are willfully multiplied. He states also that the larger the percentage of impurities, the greater the quantity of asphalt that must be used to get the proper amount of bitumen in the mixture. He says: "A pavement deficient in asphaltic cement or laid with a too hard cement crumbles under traffic.

Defective spots sometimes occur that are due to poor binders; this is more noticeable with coal tar binders than those made of asphaltic cement. An excess of cementing material in the binder tends to soften the wearing surface. In a binder mixed too rich the asphalt cement or tar flows to the bottom of the load in transportation, and that unloaded last from the wagon on the street is

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mushy. Coal tar particularly seems to soften the wearing surface; the piece affected will have a strong odor of the tar and give a greenish fluorescence in carbon bi-sulphide. Illuminating gas is also said to have an injurious effect on asphalt, Mr. Dow of Washington stating that patches have been ruined from this cause in fourteen months.

A good asphalt surface depends as much on its proper preparation as on the raw materials entering into its composition. The material was frequently burned in the past by allowing the sand to become overheated. This danger is avoided in the newer plants by the use of a steam jacket in place of direct heating. The burden of the responsibility of properly handling their product must be made to rest on the paving company by the enforcement of their guarantees.

In Mr. Bardol's estimation water is the chief cause of disintegration of asphalt pavements and he atributes to it the nodules or macaroon spots which constitute a large percentage of the defects. These spots break up in lumps and have some apparent regularity of form. They break from the bottom upward, and if examined it will be found that some grains of sand, particularly those near the bottom, are not covered with asphaltic cement; also that the bond between the wearing surface and the concrete is broken, allowing the former to become rough and wavy. He states that water standing on the surface injures the pavement, some asphalts being affected more easily than others. Damage, however, comes from the moisture under the pavement, which finds its way there through the cracks from railway tracks, through holes in the wearing surface, and from the adjoining earth. As a rule the ordinary fine cracks do not, Mr. Bardol believes, allow water to reach the foundation, for they soon become filled with dirt. The amount of water percolating through the pavement between and along the rails of a track depends on the type of track construction. A concrete base under the roadway, with a heavy rail and a first-class impervious pavement between the tracks and rails, does not allow water to reach the foundations except through the joints along the rail and pavement, particularly along the inner lip of the rail, which forms a trough or conductor for the water. A drain tile placed just beyond the outer rails would tend to intercept any leakage and is advisable on all streets having car tracks. Water entering holes in the wearing surface must of necessity affect the adjoining pavement, particularly in the case of holes formed during the winter, which cannot be repaired until spring. All that can be done is to fill up the holes as soon as practicable. The general practice in Buffalo since 1892 has been to place drain tile behind the curbs, which tends to intercept whatever water finds its way under the pavement. Its efficiency depends upon proper laying and freedom from disturbance afterward. Attention has been called frequently to instances where companies using the streets set poles without regard to the drain tile. This is also true of plumbers in connections.

Regarding criticisms that have been made about the manner in which the repairs are made in Buffalo and the assertion that some spots are repaired twice, he says: "This cannot be denied, but the city is protected because the patches are guaranteed for three years and in case they fail the company replaces them without cost to the city. Nearly $50,000 was deducted from the bills for asphalt paving presented during 1897-99 for patches which did not wear well during these three years. In order to ascertain the amount of overlap, each patch is located on a profile showing its exact size and position, the amount of work done in different years being indicated by different colors. The magnitude of this work can be appreciated from the fact that about 100,000 patches are made annually. Overlaps are deducted when the patches fail from any cause. It is evident that when a defective spot is marked it is impossible to say how long the old material to which the patch is joined will stand, and the patch will, of course, suffer with the old material." He says that much of the criticism about repairing was due to the failure of patches put in with the Perkins heater by the skimming process. Until two years ago this method was used almost exclusively. Since then it has been used only in repairing settlements. Buffalo's experience in patching has been that where the original material is sound and a depth of one inch is given for the skim, the patch, if carefully made, will hold. Its cheapness has been the only reason for its extensive use, the cut out patches costing 50 per cent. more. The committee on street paving of the American Society of Municipal Improvements recommended it in 1892. Mr. Bardol says the present practice is to cut out the defective material down to the concrete. The specifications provide the following: "The binder will be hauled to the work while hot, carefully spread on the base with hot iron rakes to such a depth that the least thickness from the topping or wearing surface will be 1½ inches, when the sum of the topping and binder is not over 2 inches. Beyond this the thickness of the binder may be increased."

Indiana Bill Providing Gravel Road Supervision.

A bill will be introduced in the Indiana legislature by Senator Johnson, of Craw-

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fordsville, to change the system of maintaining gravel roads. Under the present system the gravel roads are looked after by the supervisors of districts. These supervisors receive small pay for their work, and cannot be expected to devote the time and care to it that they would if they were better paid and had more time for their work. The proposed bill provides for a superintendent of gravel roads for each county, whose duty it will be to take care of these roads, let the contracts for supplies for keeping the roads in good repair, and award these contracts by the year. The office will be an appointive one.

Good Roads Economy.

The following is an extract from the annual address of the President of the Illinois Society of Engineers and Surveyors at its recent convention:

One of the most widely extended causes of complaint in a prairie state like Illinois is the condition of its roads. There is a wide difference in the opinion of the people regarding the proper handling of this subject. The engineer wants a road that can be traveled over at any season of the year, no matter what it costs. While the poor farmer with a small outfit and little return for his badly directed labor cannot see the advantage of taxing himself for this kind of a road when the present roads are passable for a fairly large proportion of the year and can be kept passable in good weather with a small amount of labor and no expenditure of money. The engineer has had all of the argument with him until the extravagance of some of the claims made by the advocates of good roads has brought about a reaction which bids fair to go as far in the opposite direction with the same disregard for actual fact. As usual the middle ground is the safest.

The engineer must recognize the fact that a good road may cost so much that it is not good economy to build it. That anything which an engineer would call a good road is beyond the limit of economy for a large majority of the road mileage, especially in the central and southern portions of the state, is a proposition which can hardly be considered open to discussion. The engineer, then, must accept the situation, if he is wise, and put himself to experimenting on the making of good enough roads at less cost. In this connection I would suggest a consideration of the results of the experiment recently made by a California road supervisor with hot heavy oil in forming an asphaltic sort of surface for a road which Illinois roads can be made to approximate at very little expense.

On the other hand, the farmer must finally recognize the fact that the ability to get to town at will and to communicate at pleasure with neighbors, friends and business connections is worth a considerable sum of money. I have had too many experiences with farmers shut out of the world for days on account of bad roads with good weather, to have any sympathy with the argument that the farmer's time in hauling he can do it when he has nothing else to do. I am not speaking of the farmer who will not go to see his sick daughter a mile away because it is not easy to get out the team that can go there over the road, nor of the one who burns his corn because it is easier to do that than to take it to market and bring home the equivalent in coal, and what little balance of profit there may be, but of the wide awake farmer who is always on the lookout for business and who utilizes to the utmost the force necessary to carry on the farm; the farmer whose like is coming into possession of the valuable land more and more each year. I have quoted elsewhere the case of the farmer who lost enough on the difference in price on his wheat between the day of high prices and the first day he could get to market to pay his year's assessment on a good road. His case of course was paralleled to some extent by that of every farmer on the road. True economy demands therefore a careful study of the conditions of the area served by a road and a decision as to character and cost of road in accordance with the data thus obtained, eliminating theories, attractive or otherwise, which cannot stand the light of these facts.

New York "Stone Cutters' Law" Invalid.

An opinion handed down Dec. 31 by the appellate division of the New York supreme court, renders inoperative the act of 1885, known generally as the "Stonecutters' law." A statute enacted five yeare ago required that all stone used in municipal work in the state of New York, except paving blocks and crushed stone, should be worked, dressed and carved within the boundaries of the state.

The case in which the opinion was rendered was that of Ralph J. Treat, a contractor, who sought to obtain $3,218 as an installment on sewer work. Bird S. Coler, comptroller, declined to pay on the ground that Treat was not using stone cut in the state of New York, and he was sustained by the lower court. The relator contended that the clause in the contract inserted in pursuance of the statute to carry out its provision was in conflict with the act of congress of July 2, 1900, declaring illegal various contracts, combinations or conspiracies in restraint of trade or commerce among the several states; also, that the statute is in conflict with the state constitution and the fourteenth amendment of the United States constitution.

Cost of Indianapolis Improvements in 1900.

The annual report of the city assessment bureau of Indianapolis, Ind., for 1900 has been completed by Myron D. King, chief of the bureau. A comparison of the work accomplished in 1900 and in 1899, shows a material decrease in municipal improvements during 1900. The fact that by the end of the year 1898 nearly all of the prominent

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crops to market is worth nothing, because streets in the city were improved, is cited by Mr. King as a reason for the decrease. The net decrease for 1900 over 1899 was $283,-362.36. There are still many streets to be improved, but the majority of the unimproved streets cannot be permanently improved because the law provides that the cost of improvement cannot exceed 25 per cent. of the value of the property. In 1899 five main sewers and eight local sewers were built at a cost of $108,245.79 and in 1900 no main sewers and twenty-three local sewers were built, at a cost of $49,560.17; decrease, $58,-685.62. In 1899, 73 cement and four brick sidewalks were built at a cost of $99,477.12, and in 1900 forty-nine cement walks and no brick walks were laid at a cost of $56,318.89; decrease in cost, $43,158.23. Alleys were constructed in 1899 as follows: Brick, 17; gravel, 23; bowlder, 2; asphalt, 1; cost, $26,201.77; in 1900, brick, 7; gravel, 8; cost, $5,168.06; decrease in cost, $21,033.71. Roadways in 1899: Gravel, 26; block, 8; asphalt, 5; brick, 5; cost, $294,835.35; in 1900, gravel, 18; block, 3; asphalt, 4; brick, 9; cost, $140,129.59; decrease in cost, $154,761.13. The cost of sprinkling in 1899 was $45,766.64; in 1900, $40,086. 90; decrease in cost, $5,679.74. The reason given for this decrease is that the city let the contract and paid for the work. The cost of sweeping in 1899 was $44,374.81 and in 1900 was $44,275.55, decrease in cost, $99.26.

Concrete for Lining Colliery Drifts and Shafts.

Concrete has been extensively used instead of brickwork for lining circular shafts, drifts, air-passages, etc., at the collieries of the John Cockerill Company at Seraing, in Belgium. The Engineering and Mining Journal says: "The concrete used has been made entirely from blast furnace slags, those from forge iron, broken to 30 or 50 mm., being used as ballast, while the mortar is made of granulated slags, hydraulic lime in the proportion of 5 to 1 by volume and slag cement. These are incorporated in a mortar-mill, but no addition of water is necessary, as the granulated slag contains enough. Slag cement is made of about 75 per cent. of granulated gray iron slags and 25 per cent. of slacked lime. When the slags are tolerably uniform in character chemical analysis of the materials is not necessary except when the furnace charges contain magnesia, which should not be present to a greater extent than 3 per cent. The materials required for a cubic meter of concrete are 0.750 cubic meter granulated slag and 0.150 cubic meter hydraulic lime."

Comparison of Cost of Systems of Disinfection in Havana.

After an investigation of the Woolf system for the electrolysis of sea water, which has been and is in use for disinfection purposes in Havana, Cuba, Walter Reed, surgeon, U. S. A., says:

It seems fair to conclude that had the sanitary authorities of Havana resorted to chloride of lime as the disinfectant instead of electrozone, the work of disinfection would have been more thoroughly carried out and the insular funds would have been richer by $69,231.

Major Reed says further that chloride of lime to which hydrochloric acid has been added, is rendered as effective in disinfectant qualities as electrozone, and is very much cheaper. These two agents are readily procurable, and the cost of 24,000 gallons of disinfectant, says Major Reed, would be only $76.06 per day. The total expenditure for sufficient chloride of lime and hydrochloric acid to have supplied a disinfectant having 146 grains of available chloride per gallon, from July 1, 1899, the time the Woolf system was placed in operation, until March 31, 1900, would have been $17,802. The electrozone plant cost for this length of time $75,000.

City Engineer of Hamilton, Ont., Reports on Sewage Disposal.

The annual report on the sewage disposal works has been prepared by City Engineer Barrow at Hamilton, Ont. During the last year the works have been operated at an expenditure within the appropriation, although considerable work was done in the way of improvement at both works, and wages were increased. Attention is called to quite an increase in the flow of sewage during the year, and also to the large amount of water waste, which has been quite noticeable. The consumption of water has been over ninety gallons per capita, whereas seventy gallons per capita should be ample. At the Ferguson-ave. station the total flow of sewage was 918,214,571 gallons, and for the east end station, 391,951,166 gallons, making a total of 1,310,165,737 gallons, which is an increase of about 10 per cent. over the flow of last year. Plans have been prepared and estimates submitted for a sewage disposal station at the west end, and for extending the present brick sewer into deep water. The proposed method of purification is the bacterial or biological system.

The Discovery of Septic Tank Action Followed by Filtration in Sewage Purification.

The communications that have appeared in Municipal Engineering during the last two or three months have covered the field quite fully and given the information upon which an opinion can be based by our readers as to the origin of the septic tank and claims regarding its invention. The following letter is given for the item of informa-

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tion it contains and closes the cases until something new and important appears.

To the Editor of Municipal Engineering:

Sir—In your current issue Mr. J. N. McClintock refers again to Mr. Glover's expired patent of 1882 to substantiate the claim of his company to control the use of septic tanks. This was familiar to me when my previous communication was written and does not in my judgment help Mr. McClintock's claim. I have no desire to enter into any controversy, but would, in the interest of the engineering profession, suggest to your readers that a personal examination of copies of the patents to which Mr. McClintock refers will probably dispel any apprehension, founded on Mr. Glover's claim, as to the right of the public to use the septic tank process. An attempt to control the use of septic tanks appears in patents Nos. 634,423 to 634,428, inclusive, of Oct. 3, 1899, issued to Donald Cameron and associates, but these also apply to special forms and devices and can hardly be stretched to cover the exclusive use of so old an appliance. JOS. O. OSGOOD.

New York, Jan. 2, 1901.

Plans for Septic Tanks Declared Insufficient for Columbus, O.

The Ohio state board of health has disapproved the proposed plans for a septic tank system of sewage disposal for Columbus, for the following reasons:

First—The possibility that open septic tanks for 40,000,000 gallons of sewage will of themselves create a nuisance.

Second—The certainty that septic tanks alone will not prevent pollution of the river in low water, nor remove the nuisance, the chief object for introducing sewage purification works.

Third—The excessive cost of artificial filters that will be required to purify the septic tank effluent, and the uncertainty with regard to the life of such filters.

Fourth—The lack of exact, scientific knowledge of the septic tank process under varying conditions (i. e., with sewage of different compositions) and the possibility that this process on a large scale may not prove to be of permanent value.

This action of the state board of health throws back upon the sewer commission the whole problem of sewage disposal without any recommendation of a plan that would be satisfactory to the board.

Electrical Pumping for Havana Sewage.

Electrical machinery is proposed as a part of the equipment for a new sewerage system for the city of Havana, Cuba. The Electrical Review gives information regarding the proposed scheme as follows:

The sewage of the entire city is to be collected on the west side of the harbor in a siphon, raised at the main pumping station twenty-four feet and discharged through an outfall tunnel and sewer 1,190 meters long, and thence into the sea in thirty feet of water through two five-foot pipes. At the discharge well on the west side of the harbor, where the sewage is first collected, a centrifugal pump with a capacity of 30,000,000 gallons per day, eleven feet lift, direct-coupled to an electric motor, will be installed for temporary use, while the siphon and permanent station are being built for emergency use thereafter. It is proposed to purchase the current required to drive this pump.

In Vedado, a suburb of Havana, two substations, which will be of underground masonry contruction, will be built. One of these will contain two sub-lifts, each consisting of a motor and direct-coupled centrifugal pump with a capacity of 2,500,000 gallons of sewage per day for a lift of nine feet, and the other will contain two sub-lifts, each with a capacity of 800,000 gallons per day, the lift being ten and one-half feet. Both sub-stations will be arranged to work automatically. These stations are both to be supplied from two direct-coupled electric generating outfits of twelve kilowatts capacity installed in the main Vedado pumping station.

Bonded Indebtedness of New York City.

In his annual message to the municipal assembly Jan. 15, Mayor Van Wyck of New York City stated that the bonded indebtedness of that city on Jan. 1, 1901, was $279,725,370.38, an increase of $24,949,334.97 during the year 1900. The amount of the bonds which appeared in Jan. 1, 1900, has been reduced during this period, however, by the sum of $4,440,917.39 so that the actual increase has been $20,508,417.58.

Sewage Disposal at Brookfield, Mo.

A simple method of sewage disposal for a small town has been constructed at Brookfield, Mo., from plans of Mr. Hiram Phillips, M. Am. Soc. C. E. No great claims are made for the method, but it is believed that it will serve the purpose for which it is intended,—to confine the offensive odors to the vicinity of the disposal works and to remove the solid matter in suspension in the sewage.

Brooklyn has a poulation of about 6,000. The disposal plant covers an area of about ten acres, which is sufficient under present conditions. The disposal system consists of two carrier flumes running along the upper side of the field each way from the highest point, at which the sewage is delivered, and a series of settling ditches. Sewage is delivered from the flumes by sluice gates at any desired point into the ends of the ditches running across the fields. The lower ends of these ditches are all connected with a ditch running along the lower side of the field, which empties by an outlet ditch into a small natural watercourse. There are sluice gates at each end of each of the settling ditches so that the sewage flow can be directed entirely or in any part through any ditches desired. The fall in all the flumes and ditches is very slight, so that the settlement of suspended matters is practically complete. When ditches are

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clogged by sewage matter they can be filled up with the dirt excavated from new ditches adjacent and later the same area can again be used for a ditch. During the summer very little, if any, of the sewage reaches the natural watercourse, all having evaporated or percolated into the soil. The field has been in operation about a year.

Midland Municipal Officers' Association, England.

A Midland Municipal Officers' association was formed in Birmingham, England, recently. The association will represent a radius of twenty miles from the center of Birmingham. Only permanent officers holding appointments under county, borough and district councils will be eligible. In addition, the membership will practically be confined to those who are connected with the constructive work of local authorities, such as divisional and district surveyors, road surveyors generally, superintendents of parks, sewage farm managers, etc. The general objects of the association include the advancement of the general knowledge and capabilities of the members, by arranging for periodical lectures, essays and discussions on subjects of common interest, such as road construction and maintenance, sewage disposal, water supply and other questions of sanitation, electric lighting, traction and other branches of municipal work, supplemented as opportunities occur, by visits to local works in progress. W. H. Clary, borough surveyor of Sutton-Coldfield, was elected president.

Convention of Illinois Society of Engineers and Surveyors.

The Illinois Society of Engineers and Surveyors held a very successful convention at Bloomington Jan. 23-25 under the direction of President Charles Carroll Brown and the Executive Secretary and Treasurer, M. S. Ketchum of Champaign. An important paper was that by Wm. H. Herron, upon a topographic survey of the state. A co-operation with the United States Geological Survey was recommended and a clear and forcible presentation of the value of the kind of survey and map proposed was made. The result of the ensuing discussion was a series of resolutions indorsing the proposition and asking its consideration by the legislature.

The evening session of Wednesday was devoted to the discussion of the various phases of the good roads question. Prof. Baker's paper on the "Cost of Earth Roads" and Mr. A. H. Bell's paper on the "Hard Roads of McLean County" were practical papers, selections from which will appear in our columns hereafter. Prof. Baker also presented a paper on the "Cost of Wagon Transportation" which aroused considerable discussion, developing some differences of opinion. The conclusions of the paper were conservative and valuable. They are as follows:

1. The ordinary maximum cost to freighters on earth roads is not more than 25 cents per ton-mile.
2. During the summer months the cost to freighters on level loam roads is about 20 cents per ton-mile.
3. With a little choice as to the time of doing the work, the cost to the farmer is not more than 10 to 12 cents per ton-mile on earth roads; and where farm work is not pressing the cost is not more than 6 to 9 cents per ton-mile.
4. The cost to farmers of hauling upon the best stone roads would not be much less than the cost upon earth roads when in their best condition, since the best earth roads are nearly as good as stone roads.
5. The cost of hauling upon stone roads is much less than upon muddy earth roads, but most farm produce that goes to market in full loads can wait for a favorable condition of the earth roads. The possible saving in the transportation of freight by wagons through road improvement will be an insignificant part of the cost of such improvement. This does not mean that the roads should not be improved, but it does mean that no great improvement can be justified alone on the ground of reducing the cost of transportation.

That one large factor in the value of good roads is the reduction in the amount of fluctuation in prices of farm products, was a point prominently brought forward, and it was decided that this made good country roads of value to every citizen of the state. A resolution approving of the movement for state aid in building good roads was therefore passed. The principal part of the report of the committee on paving brick tests is given elsewhere. There were several good papers and discussions upon brick and brick paving, and Mr. W. H. Tarrant's paper upon the subject will appear later

As usual the committee on railroads presented an excellent report and a number of good papers on railroad matters. Two new committees on architecture and on mechanical engineering also contributed largely to the value of the meeting. Prof. N. C. Ricker's description of the working of the Illinois law for the licensing of architects was of great value, as showing the success met with in this first application of the principle to a profession of this nature. The success reported in this line led the society to believe that a similar success would follow the passage of a similar law regarding the practice of surveying, and the full influence of the society will be thrown in favor of a bill of this nature. Some extracts from Mr. B. J. Ashley's paper on "Designing a City" will appear later as giving the practical detail of planning a city from a novel and unusual standpoint.

The officers elected are: President, H. G. Paddock, Moline; vice-president, Emil Ru-

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dolph, Chicago; trustees, P. C. Knight, Pontiac; J. G. Melluish, Bloomington. The next meeting will be held at Joliet.

Commission on Improvement of Chicago River Appointed.

A committee of five experts has been appointed to consider the improvement of the Chicago river, and to report its conclusions to the trustees of the Chicago sanitary district March 1. The committee is as follows: Lyman E. Cooley, Ambrose V. Powell, L. P. Friestedt, to solve engineering problems; Orrin N. Carter, John P. Wilson, to consider legal aspects of the situation. In addition a committee has been appointed to co-operate with the foregoing committee, as follows: Major J. H. Willard, in charge of the river and harbor district; Lawrence E. McGann, commissioner of public works; Corporation Counsel Walker, representing the city; Chief Engineer Isham Randolph, General Counsel John S. Runnells and Z. R. Carter, chairman of the finance committee, in behalf of the sanitary district. An invitation has been extended to the state board of health, the city health department, the board of trade, the real estate board and the River improvement association each to appoint a representative on the committee.

Annual Meeting of American Society of Civil Engineers.

The annual meeting of the American society of civil engineers was held Jan. 16, and officers were elected to serve during 1901, as follows:

President—J. James R. Croes, New York City.

Vice-Presidents—Henry S. Haines, New York City and George H Benzenberg, Milwaukee, Wis.

Treasurer—Joseph M. Knap, New York City.

Directors—Josiah A. Briggs, New York City; George F. Swain, Boston, Mass.; Emil Kuichling, Rochester, N. Y.! Mordecai T. Endicott, Washington, D. C.; Edward C. Carter, Chicago; Frank C. Osborn, Cleveland, O.

The Norman medal for the year ending with the month of July, 1899, was awarded to E. Herbert Stone, M. Am. Soc. C. E., for his paper on "The Determination of Safe Working Stress for Railway Bridges of Wrought Iron and Steel." The Thomas Fitch Rowland prize for the same year was awarded to R. S. Buck, M. Am. Soc. C. E., for his paper entitled "The Niagara Railway Arch." The Collingwood prize for juniors for the same year was awarded to Julius Kahn, Jun. Am. Soc. C. E. (now Assoc. M. Am. Soc. C. E.), for his paper entitled "The Coal Hoists of the Calumet and Hecla Mining Company." Awards for the year ending with June, 1900, were as follows:

The Norman medal, to James A. Seddon, M. Am. Soc. C. E., for a paper on "River Hydraulics."

The Rowland prize, to Allen Hazen, M. Am. Soc. C. E., for a paper on the "Albany Filtration Plant."

The Collingwood prize, to Robert P. Woods, Jun. M. Am. Soc. C. E. (now Assoc. M.), for a paper on "Street Grades and Cross Sections in Asphalt and Cement."

The following nominating committee was elected: Ira A. Shaler, district No. 1; S. E. Tinkham, district No. 2; J. F. Alden, district No. 3; P. L. Wolfel, district No. 4; Onward Bates, district No. 5; R. Montfort, district No. 6, and C. D. Marx, district No. 7.

The committee on cement reported progress, and was authorized to add to its numbers in its own discretion.

Convention of Michigan Engineering Society.

The twenty-second annual convention of the Michigan Engineering society was held at Ann Arbor, Mich., Jan. 8, 9 and 10. The program contained the following papers: "The Life Work of George E. Waring, Jr.," G. Everett Hill., C. E., New York City; "The Surveyor in the Presence of the Court," Prof. J. C. Knowlton, Ann Arbor; "The Topographical Survey of Michigan," Prof. I. C. Russell, Ann Arbor; "An Odd Job for Uncle Sam," A. W. Barber, Washington, D C.; "The Available Water Power of Michigan and Its Economical Development," Robert E. Horton, Jr., United States geological survey, Utica, N. Y.; "The Marls and Clays of Michigan," Prof. Delos Fall, Albion, Mich.; "The Manufacture of Portland Cement," Bernard L. Greene, C. E., Cleveland, O.; discussion, "Cement Manufacture in Michigan;" "Cost of Installing a Water Meter System," A. L. Holmes, Grand Rapids, Mich.; "Stand Pipes and Elevated Reservoirs," George S. Pierson, Kalamazoo; "Electrolysis," W. W. Brigden, Battle Creek; "Deep Well Supply," Micah Walker, Fenton; "Retrospective and Prospective Views of Water Works," George L. Wells, Buffalo, N. Y.; "Asphalt Pavements of Pontiac," William J. Fisher, city engineer, Pontiac; "Suitable Streets for Small Towns," Frank F. Rogers, Port Huron. Report of committee No. 4; "Roads and Paving," presented by George M. Ames, chairman, Grand Rapids, and followed by discussion. "The Toll Roads of Michigan," D. Farrand Henry, Detroit; "The Many-Sided Engineer," Francis Hodgman, Climax; "A Professional Esprit de Corps," George S. Pierson, Kalamazoo; "Accomplishing the Impossible," H. K. Whitney, Battle Creek; "City Boards and Councils," F. F. Rogers, Port Huron; "What We Drink," Micah Walker, Fenton; "That Base Line," Dorr Skeels, Grand

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Rapids; "An Engineer's Place in Politics," E. W. Muenscher, Manistee; "The Question of an Engineering Job," Prof. M. E. Cooley, Ann Arbor. Officers were elected for the ensuing year as follows: President, William B. Sears, Saginaw; vice-presidents, M. E. Cooley, Ann Arbor; A. L. Holmes, Grand Rapids; Joseph Ripley, Sault Ste. Marie; secretary and treasurer, Francis Hodgman, Climax. The next convention will be held in Grand Rapids. Some of these valuable papers will appear in our columns at an early day.

Washington to Have a State Road Commission.

A bill will be presented to the Washington state legislature, which proposes to appoint a state road commission, which will have entire charge of the construction of roads throughout the state. The roads thus built will be state highways, and one-half of the expense of building will be borne by the state. A state road commission is to be appointed at a salary of $3,000 per year.

Engineering Association of the South.

At the regular monthly meeting of the Engineering association of the South Jan. 10 it was decided that the continuance of individual publications was preferable to uniting with the Journal of the Association of Engineering societies. W. H. Holmes, an American engineer who has recently returned from Korea, presented a paper giving a description of the methods of doing some bridge pier foundation work in Chemulpo. The system of keeping records of rivers in that ancient country was briefly described. They extended back into the past for many centuries and are said to be very accurate. Mr Holmes stated that where an opportunity offered itself for a check the records were in every case sustained. The record for the river in question extended back 509 years and explanation was made at the beginning of the records that the history of the river previous to that time had been consumed in a fire which had burned the house and all contents. Julian Kendrick, city engineer, Birmingham, presented a paper giving an exhaustive and interesting study of the sewage problem now confronting the Birmingham district. The geographical features of the drainage area were described, the difficulties, in carrying out the various methods of sewerage set forth and finally a plan proposed.

Technical Meetings.

At the meeting of the American Society of Civil Engineers for Feb. 6 Charles L. Crandall will present a paper on "The Adjustment of a Transit Survey Compared With That of Compass Survey." At the meeting of Feb. 20 Mr. G. N. Houston will present a paper on "The Construction of Gravity Sand Filters at Nyack, N. Y.

The third annual convention of the League of California Municipalities was held in San Francisco Dec. 12, 13 and 14. Officers for the ensuing year were elected as follows: President, Joseph Hutchinson, Palo Alto; first vice-president, Mayor Parker, Santa Cruz; second vice-president, Mr. Canfield, Chico; secretary, H. A. Mason, re-elected. Los Angeles was selected for next meeting place.

The twenty-second annual convention of the Ohio Tile, Brick and Drainage association will be held at Columbus, O., Feb. 12 and 13.

The Civil Engineers and Architects' club was organized at Burlington, Ia., Jan. 12. Emmet Steece was elected president and Ralph Slippy secretary. A committee on by-laws was appointed, composed of the following: Fred W. Salmon, M. E. of Murray Iron Works, chmn.; N. C. Hurst, M. E. of C., B. & Q. R. R.; Ralph Slippy. The committee was directed to report Jan. 19. The club expects to have a membership of about sixteen when organized.

The annual convention of the Indiana Engineering Society will be held at Indianapolis, Feb. 14th, 15th and 16th. Among the important papers to be presented are J. B. Nelson's on "Municipal Control of Water Works and Electric Lighting Plants," A. J. Hammond's on "Steam Pollution," R. L. Bailey's on the "Relation of Engineer and Contractor," V. K. Hendricks's on "Concrete as a Substitute for Brick and Stone Masonry," W. D. Pence's on the "Design and Construction of Masonry Arches," W. K. Hatt's on the "Strength of American Slag Cement," S. B. Newberry's on the "Manufacture of Portland Cement in America." Other good papers are on the list and the meeting will be profitable and interesting. J. S. Spiker of Vincennes is president.

The New England Water Works association elected officers Jan. 9 at its annual meeting as follows: President, F. H. Crandall, Burlington, Vt.; vice-presidents, Charles K. Walker, Manchester, N. H.; James Burnie, Biddleford, Me.; William E. Hawks, Bennington, Vt.; F. E. Merrill, Somerville, Mass.; F. G. Hazard, jr., Narraganset Pier, R. I.; Charles F. Chandler, Norwich, Conn.; secretary, William Kent, Narraganset Pier, R. I.; treasurer, L. M. Bancroft, Reading, Pa.

The Engineers' Society of Western Pennsylvania will hold its annual banquet Feb. 21 at Pittsburg. Reginald A. Fessenden, 410 Pennsylvania-ave., secretary.

The fifteenth annual convention of the National Brickmakers' association will be held at Old Point Comfort, Va., Feb. 11 to 16. The program contains the following papers: "Brick Pavements and the Engineer," Taylor Gleaves, Lynchburg, Va.;

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"Durability of Brick Pavements," Will P. Blair, Terre Haute, Ind.; "Specifications for Construction of Brick Pavements," D. V. Purington, Chicago; "Twentieth Century Brickmaking," W. S. Ravenscroft, Ridgeway, Pa. Some of the questions for general discussion will be:

Can clay or shale be ground too fine to make good paving brick?

Is it necessary for a plant making 24,000 or more paving brick per day to use any coal fuel beside that used for burning?

Can as dense a paving brick be made out of a soft bar of clay as out of a stiff one?

Cannot a better paving brick be made from mixture of proper materials than from any single clay or shale now used for the purpose?

D. V. Purington will submit the report of the committee on "Specifications for Construction of Brick Pavements."

The ninth annual convention of the Northwestern Electrical Association was held in Milwaukee, Wis., Jan. 16, 17 and 18. Among the papers presented were the following: "Practical Line Construction," Loren W. Burch, Madison, Wis.; "The Rate Question," Henry L. Doherty, New York City; "Synchronous Converters," Prof. W. E. Goldsborough of Purdue University, Lafayette, Ind.; "The Series Incandescent Lighting System of the Future," P. D. Wagoner; "The Trade Education of Central Station Employes," Prof. D. C. Jackson. Officers for the ensuing year were elected as follows: President, E. L. Debell; first vice-president, S. B. Livermore; second vice-president, W. Worth Bean; secretary and treasurer, Thomas R. Mercein. Directors—L. E. Kerns, Wisconsin; J. H. Harding, Indiana; Charles Cuno, Wisconsin.

The one hundred and fiftieth meeting of the American Institute of Electrical Engineers was held in New York City Jan. 25. Prof. W. Elwell Goldsborough of Lafayette, Ind., presented a paper on "Air Gap and Core Distribution," and a paper by William B. Vansize of New York City on "A New Printing Telegraph."

The seventeenth annual meeting of the Connecticut Civil Engineers' and Surveyors' association was held in Hartford Jan. 9. Among the papers presented were the following: "The New Britain Electrical Subway," F. H. Oldershaw, city engineer New Britain; "The East Hartford Sewerage System," C. Henry Olmsted; "The Storm Water Problem of Hartford," Frederick L. Ford, Hartford; "A 24-inch Vitrified Pipe Conduit," W. E. Johnson, engineer Hartford water board. Officers were elected as follows: President, Henry J. Kellogg, New Haven; first vice-president, Clarence B. Voice, Hartford; second vice-president, A. J. Patton, Waterbury; secretary and treasurer, George K. Crandall, New London; assistant secretary, John K. Punderford, New Haven.

A permanent state organization of county engineers is proposed in New Jersey, and efforts will be made to secure legislation that shall provide uniformity of roads built in the different counties.

New Publications.

Hendricks' Architectural, Engineering and Mechanical Directory of the United States, over 1,200 pp., full cloth, $5.00. S. E. Hendricks Company, No. 61 Beekman-st., New York, N. Y.

The edition for 1901 of this valuable book has just been issued. It increases in size from year to year, and now contains nearly 350,000 names. The special increase in the lists in cement and road machinery industries is marked. Aside from a special publication on a single industry it is probable that this directory is more nearly complete and accurate than any other covering the same field.

Municipal Public Works—A discussion of matters of public interest to municipal officials, by Ernest McCullough, 153 pp. paper 50 cents. Published by the author, Lawiston, Idaho.

A second edition of this book being called for, it has been rewritten and the number of pages more than doubled. The chapters are on streets, drainage and sewerage, water supply, street lighting and fire department, plans and surveys, municipal ownership and the city engineer. While the last chapter is perhaps for engineers only, the book is not written for them alone, but more properly is for the citizen who is interested in municipal improvements.

It is in most respects the best book written with this object which has yet appeared. It is somewhat indefinite at times on matters which the citizens would like detail upon, but it is difficult to draw the line, and without largely increasing the size of the book there could not be much change in this regard. Both the municipal official and the civil engineer will be benefited if the hints given in the book are followed. It is not a guide for the city official to the design and supervision of work, but it instructs him in the general principles of public improvements and preaches the sound doctrine of expert aid. The chapter for the engineer in the small city is quite valuable, especially in its reference to periodicals and books for his library and to proper business principles.

The price of Frizell's Water Power, which was noticed last month, is $5.00.

A new bibliography of the world's literature on municipal problems and city conditions will be given in the quarterly number of Municipal Affairs for March, 1901. It will cover four or five hundred octavo pages with about 20,000 entries, including a topical classification and entries according to county and city, and also a list of authors. It is three or four times as large as the list published about four years ago.

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Venezuelan Insurgents Endanger American Life and Property.

According to advices received Jan. 29 from Caracas, a trustworthy engineer, who has arrived there from Pitch lake, reports that the situation is critical. He says 150 English negroes who were employed to do police duty fled when the insurgents began firing into the jungles, only twenty-five Americans being left to protect the property and lives of American families. The messenger from the lake implored the United States legation at Caracas to afford protection, saying that the lives and property of Americans were exposed to guerilla attacks, firing around the lake going on nightly, and the Americans being too few to hold out long. United States Minister Loomis, according to the same advices, replied that these reports were possibly exaggerated, but that they could not be ignored, and that he would wire the facts to Washington.

The revolution in eastern Venezuela, near the asphalt deposits, is increasing, but the disturbances are remote from Caracas, which remains tranquil.

The International Asphalt Company.

The International Asphalt company was incorporated at Springfield, Ill., Jan. 9, with a capital stock of $100,000, by R. F. Conway, J. F. Reed and J. J. McCarty. The company has some large projects in view, but is not yet ready to disclose any of its plans.

Gleanings from Annual Reports of City Departments.

The report of Charles A. Brown, Superintendent of Streets in Cambridge, Mass., shows the expenditures for the year on bridges, $2,462.28; on cleaning streets, $34,499.79, of which about 10 per cent. was for new sweeping machines; collection of ashes, $27,999.94; construction of two streets, $1,363.61; for maintenance of streets, $79,999.77, $29,535.46 of this amount being for resurfacing streets with broken stone and gravel; new gravel streets, $1,624.43; paving sidewalks and edge stones, $24,998.42; watering streets, $26,000. Since 1898 the annual franchise tax of street railway corporations has been distributed among the cities and towns through which the companies operate their cars, in proportion to the mileage of tracks. In the three years 1898, 1899 and 1900, the city has received $124,208.35 from this source, of which $121,680.91 has been expended in rebuilding Harvard Square and Portland, Prospect, Cambridge, Portland and Pearl sts. in the years 1899 and 1900.

Joseph A. Volk, Leslie Smith and Albert E. Winchester are the Board of Electrical Commissioners of the city of South Norwalk, Conn. On failure, in 1892, to secure satisfactory service from the local company, a favorable popular vote appropriated $22,500 for construction of a plant for public electric lighting only. In 1897, after a long investigation, a further appropriation of $20,000 was made to enlarge the plant and furnish current for commercial lighting and power. This appropriation was increased in 1900 by $17,500, $2,500 being paid from earnings, thus making the total indebtedness for the plant $57,500. The receipts during the past year have been $9,740.79 from commercial lighting and power, $5,947 from city for street lighting and $521.19 for city buildings; a total of $16,408.98. The expenditures were $13,949.16, including $1,700 interest and $225.51 new construction. The net profit is computed at $2,484.86, after interest is paid, very nearly the difference between receipts and expenditures. There are 120 2,000-candle power lamps running from dusk till 1:30 a. m. Hereafter they will burn all night and the city will pay $72 per lamp per year. There are 2,934 16-candle power lights with 134 light customers and 15 power customers on the commercial lines.

The village of Ravenna, O., is putting its energies on sidewalk improvements, the total expenditure for this purpose in the year ending March, 1900, being $18,146.50, out of a total expenditure of $47,367.79. When $13,082.63 payment to the sinking fund is deducted, this leaves only $16,138.66 for all city purposes and other improvements. Of the sinking fund payment $2,000 is from the water works, which received during the year $12,999.43 and expended all but $606.32, $3,000 being to sinking fund and bond accounts, and the village paying nothing for fire protection. The works are clearing about $7,500 a year to be applied on payments of interest, on sinking fund and depreciation accounts, and profit to the city through remission of general tax for fire protection. The operating expenses were $5,481.50.

Personal.

J. D. Borders was elected mayor, Jan. 8, at Brookville, Fla.

Hamilton Flood has been appointed city engineer at Quincy, Mass.

Ernest Rands has been appointed city engineer at Oregon City, Ore.

Jeffry P. Thomas has been appointed city engineer at Watervliet, N. Y.

F. W. Dalrymple has resigned as city engineer at Hornellsville, New York.

George W. Sublette has been reappointed city engineer at Minneapolis, Minn.

Herbert A. Holstein has been appointed assistant city engineer at Dunkirk, N. Y.

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A. C. Olney, C. E., has established an office in the Duncan building, Spartanburg, S. C.

John H. Peck has resigned the office of president of the Rensselaer Polytechnic Institute.

M. H. Schillner has been appointed city engineer at Rome, N. Y., to succeed T. A. Coleman, resigned.

Talman P. Hyde, deputy commissioner of streets for the borough of Bronx, New York City, died Dec. 25.

William E. Sapp has been elected superintendent of the Mt. Vernon water works, at Mt. Vernon, O.

Paul F. Babbridge has been appointed superintendent of water works and sewers at Keene, N. H.

J. F. Correll has been appointed superintendent of the water and electric light works at Monroe, N. C.

Frank M. Sylvester has been appointed assistant engineer in the department of bridges, New York City.

John M. Fairfield, president of the board of water commissioners' Hartford, Conn., died Jan. 17 of consumption.

Col. M. A. Downing was re-elected president of the board of park commissioners at Indianapolis, Ind., Jan. 11.

Darwin Felter, superintendent of water works of Binghamton, N. Y., for twenty-five years died in that city recently.

Timothy J. Mahoney has been appointed commissioner of public works, to succeed Michael J. Healy, at Buffalo, N. Y.

James Gilbert, city gas inspector for Omaha, Neb., died in that city Dec. 31. Mr. Gilbert had filled his position since 1882.

J. H. Whitaker has resigned his position as electrician of the Northern Pacific railroad to become city electrician of Tacoma, Wash.

John Leisenring, C. E. of Upper Lehigh, Pa., died at the University hospital at Philadelphia Jan. 20, aged forty-seven years.

The address of William A. Moore, president of the National Good Roads Improvement Association, and R. W. Richardson, secretary, is 928-929 Marquette Bldg., Chicago.

A. N. Talbot, A. D. Thompson and W. K. Eldridge have been appointed a committee on brick pavements by Robt. E. McMath, president A. S. M. I., to consult with the committee appointed by the N. B. M. A.

W. W. Crosby, the recently appointed road engineer of Baltimore county, Maryland, has established his office at the county court house at Towson.

William H. Alsip, brick manufacturer, Chicago, Ill., died recently. Mr. Alsip was ex-president of the Chicago Builders and Traders' Exchange of that city.

Emil Swenson, general manager of the Keystone works of the American Bridge company, Pittsburg, Pa., has resigned his position, his resignation taking effect Dec. 31, 1900.

Frank C. Faust, formerly with the Flock & Johnson Construction company, at Murray, Ia., has accepted a position as engineer and superintendent for Robertson & Hobb, contractors, Newport, Tenn.

William R. Copeland, formerly bacteriologist for the filtration commission at Pittsburg, has been appointed bacteriologist at the testing station of the water supply of Philadelphia, to succeed Willam G. Topiis, resigned.

John H. Warder has been appointed secretary of the Western Society of Civil engineers, at Chicago, to succeed Nelson K. Litten, who has held the position since 1896.

Henry M. Clafien, president of the Clafien paving and contracting company, Cleveland, O., died Jan. 1, at St. Vincent's hospital.

Jacob A. Harman, C. E., and Herbert E. Hewitt, architect, of Peoria, Ill., have dissolved partnership, and hereafter each will practice his respective profession.

Dwight F. Burritt, Boston, Mass., has been appointed superintendent of the Portsmouth Gas, Electric Light and Power company, Portsmouth, N. H.

Dr. J. O. Jenkins, president of the board of aldermen, Cincinnati, O., was appointed water works commissioner, Jan. 5, to succeed Henry Higgins.

Bosler and Betts, civil engineers and surveyors, Chattanooga, Tenn., have removed their offices to the McGorman building, Birmingham, Ala.

James Z. George & Co. of Carrollton, Minn., have removed to Jackson, Miss., where they will conduct a general business as consulting and supervising engineers and architects.

Capt. Phillippe Bunau-Varilla, the eminent French engineer who was in charge of the Panama canal work for a number of years, was the guest of the Cincinnati Engineers' club Jan. 17.

R. S. Stearns will conduct a general contracting business in the electrical field in New Orleans. Mr. Stearns was formerly representative of the Westinghouse electric and manufacturing company in that city.

Robert P. Woods, city engineer of Wabash Ind., was awarded the Collingwood prize of $50 gold and a certificate from the American Society of Civil Engineers for a paper on "Street Grades and Cross Sections in Asphalt and Cement."

T. Hugh Boorman, for many years manager of the New York Mastic Works, has severed his connection with that company and has been elected president of the National Contracting company and vice-president of the National Asphalt, Brick and Tile company of 32 Broadway, New York City.

S. Whinery, C. E. New York City, has resigned his office as president of the Warren-Scharf Asphalt Paving company. Mr. Whinery served as superintendent and general manager of the company for thirteen years and as president since last August. His address for the present will continue to be Room 1,562, No. 11 Broadway.

Louis E. Fischer, formerly City Engineer and Superintendent of Electric Light and Water Works for Paris, Ill., has resigned to open an office at 810 Olive-st., St. Louis, Mo., as engineer for municipal corporations. He will have charge of the construction of the improvements the city of Paris is contemplating for the year.

Rupert Schefbauer was shocked to death by electricity Jan. 15 in the factory of the Sterling Arc Light company, New York City. Mr. Schefbauer was testing a device which he had invented, and while absorbed in his experiment he grasped a live wire and was instantly shocked to death. Mr. Schefbauer was chief electrician of the Arc Light company.

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Maj. Niles Meriwether, M. Am. Soc. C. E. and city engineer of Memphis, Tenn., for fifteen consecutive years, died Dec. 29 of pneumonia. During Maj. Meriwether's administration in the city engineer's department the present superior sewerage system was inaugurated and partially completed according to his plans, and under his direction.

The committee appointed at Paris last summer, during the congress of Hygiene, to make investigations and report on questions of street hygiene in their several bearings, at the next congress, is as follows: F. Andrews Meyer, Hamburg; H. Alfred Rochling, 14 Market-st., Leicester, England; Th. Weyl, 5 Carmer Strasse, Charlottenburg-Berlin; E. Almquist, Stockholm; E. Farkas, Budapest; Rudolph Hering, New York City; A. Holst, Christiania, Norwegen; P. Lauriol, 9 Place de l'Hotel de Ville, Paris; E. von Kentkowski; L. Pagliana, Turin, M. A. an der Perk, Rotterdam; J. Polak, F. Putzeys, A. Relia, F. Schmidt.

SELECTIONS FROM THE PRESS.

Expert Municipal Officials.

The clerk of the London County Council is soon to leave his office—carrying a salary of $10,000 a year—to accept a private business position, and the fact is the subject of suggestions in London municipal circles that perhaps the regular custom of advertising for candidates for this office from anywhere in the kingdom may, because of the smallness of the salary, fail to bring a first-class applicant, while the peculiar need at this transition period—when the new local government act for London is about to be put into effect—for a clerk acquainted with the details of the disappearing system, may demand his selection from among the subordinate staff. It is explained that there would be no prospect of attracting the able town clerks of Liverpool or Glasgow, since each receives a salary equal to or greater than that mentioned, and the imminence of the reorganization of local governing agencies is urged as forbidding a period of apprenticeship for a stranger to acquaint himself with the system to be transformed.

The point of the situation is, however, that the only considerations discussed are the matter of distinctive qualifications for the position and the question of where they can be found, whether in London or elsewhere in the kingdom. Any suggestion that the choice of a candidate should be limited to some political party, to say nothing of its being limited to the "workers" therein, would be treated as an absurdity.

The criticism herein contained upon our own theory and practice of municipal government goes to the roots of our admitted inefficiency therein as a nation. It explains the death of the four women and girls at last Wednesday's fire, just as, in the main, it does paving frauds, dirty streets, deranged finances, feverish school management, and inefficiency in the thousand forms in which its results are precipitated upon the public.

It is as certain and plain as anything possibly can be that ability is the only means by which the public service can be well carried on, and that "rotation in office" and selection, whether of heads of departments or of street sweepers, for political reasons, negative the idea of able administration. No one who analyzes the situation can fail to see that popular elections in American cities must somehow be brought to turn less upon persons and more upon policies, and that officials must be chosen because of their capacity to execute in a liberal and efficient manner public mandates, rather than because they trained with one particular party in such an election.

To compare the clerk in question, whose four years' faithful services have made him seem almost indispensable to the present administrative needs of London, with the city clerk of Chicago, whose one conspicuous act within the reach of recent memory was in connection with the promotion of the defeated Ogden gas ordinance, is to bring out in humiliating but wholesome contrast the cutting logic of the two sorts of political philosophy represented by the two officials.—Chicago Tribune.

Illinois State Water Supply.

During the last few years several thousand samples of drinking water from various ordinary house wells throughout the state have been sent to the state university for analysis and report as to quality. By far the greater proportion of these water samples have proved, upon analysis, to be contaminated with drainage from refuse animal matters and consequently have been regarded with grave suspicion, or have been pronounced unwholesome for use as drink.

The present prevalence of typhoid fever in a number of places in the state makes it desirable that the public should remember that the state has made provision for the examination of all suspected waters. It is not practicable to actually isolate the typhoid fever germs, or to directly prove their absence from waters submitted for analysis: this for the reason that the work entails more labor and time than is made available by the means which the state provides. However, the chemical examination is sufficient, ordinarily, to show whether the

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water is contaminated with house drainage or drainage from refuse animal matters, or whether it is free from such contamination.

All waters which contain drainage from such sources must be regarded with grave suspicion. and not used for drink unless they are previously well boiled.

Any citizen of the state may have examinations made of the drinking water in which he is interested, free from charge, by applying to the department of chemistry of the state university. Interested persons, however, should not send samples of water without first making inquiry. The department requires that the samples be collected in glass stoppered bottles, and be accompanied by a full statement as to the water and the surroundings of the well.

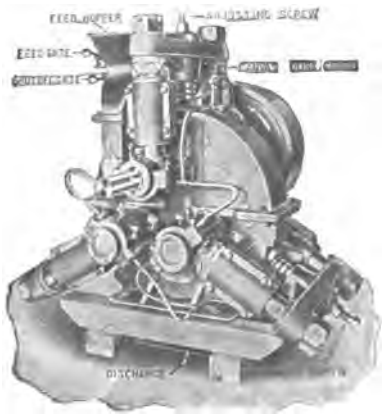
The expense to any citizen of the state, for such examinations, consists merely of the express charges which are to be paid upon the sample.—Illinois University Bulletin.

MACHINERY AND TRADE.

Kent Fine Pulverizer.

We present herewith a cut of the latest Kent pulverizer for grinding cement or limestone. This rather interesting machine is meeting with much favor for grinding limestone for use as carbonate in the top surface of asphalt pavements, cement clinker and similar substances, where a fineness of from 66 per cent. to 96 per cent on 200 mesh sieve is desired.

The principle on which the machine operates is quite distinctive, in that the rock to the depth of one inch is carried on the inner face of a heavy revolving ring, being held on this face by centrifugal force, and passing successively three internal crushing rolls,



by the outward pressure of which the rock is crushed to the fineness desired. The depth of rock between the rolls and ring affords such a body of material between the crushing faces that 95 per cent. of the rock abrades itself during reduction, thus reducing the wear on the crushing faces to about 5 per cent. of that heretofore experienced in operating such machines. The roll shafts are all mounted on cushioned bearings pressed to the work by springs, which latter hold the working parts yieldingly in position so that all vibration is taken up by the springs, thus preventing breakage and noise, and insuring a uniform crushing force.

In nine months running of one of these machines used by the Cranford company of Brooklyn, there has been no breakage, no stoppage due to the machine, and not a dollar of repair account in grinding about 8,000 tons of dust. It is claimed that the machine is just as good as the day it was started. It will reduce any screenings from two inches down to the finest dust at the rate of over two tons per hour, without requiring more than 25 H. P., and with practically no wear account. Interesting claims of the manufacturers are that the machine is noiseless and dustless in operation, and runs so smoothly that it can be set on any ground or floor without requiring a special foundation or anchor bolts to hold it down. It is guaranteed in every respect for one year and that the repair account will be less than one cent per ton.

It will be seen from the cut that the bearings are provided with water jackets so that the mill can be used to grind hot cement clinkers, roasted ore, or limestone coming from the heating drum.

The makers claim that this machine is practically indestructible; that it reduces the cost of pulverizing any hard substances at least 50 per cent. and that it can be installed in any plant at a slight expense.

Municipal Asphalt Repair Plant.

Hetherington & Berner of Indianapolis, have been awarded a contract by the city of Detroit for the construction of a stationary asphalt repair plant with a capacity of 1,500 square yards per day. The plant will be under the charge of City Engineer McCormick of Detroit. It will be of all steel fire proof construction and will embrace all of Mr. Hetherington's latest features, including steam melting and mechanical agitation. The plant will be built in one of the yards of the board of public

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works and the building will be 27½x65 feet in dimension. The cost will be $10,000. The plant will be ready for operation in the spring.

The Hylo Incandescent Lamp.

The receipt of an order for the Hylo Incandescent lamp from Manila is evidence from the farthest confines of United States territory that this convenient lamp, which can be turned down to save current and give as little light as desired, is a common-sense device which the people want. There are several kinds of lamp bases, and the kind in use must be stated in ordering, that the lamps to fit may be sent.

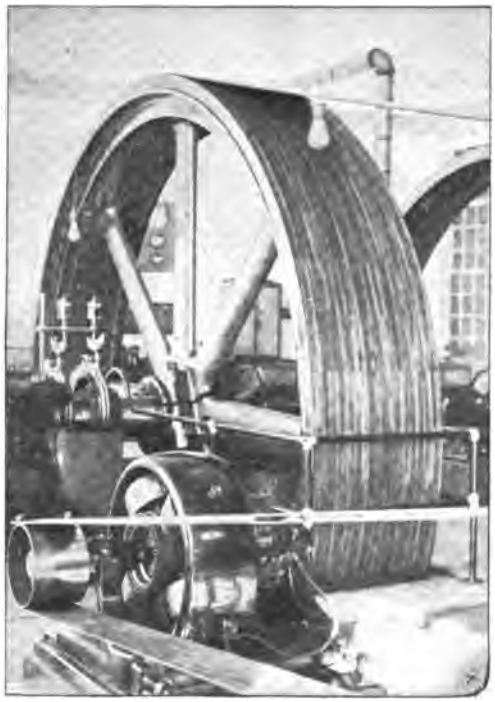
Officers of the Acme Road Machinery Company.

The annual meeting of the stockholders of the Acme Road Machinery company was held at the offices of the company in Frankfort, N. Y., on Thursday, Dec. 27, when the following directors were elected: W. A. Cook, the Hon. Elliot Danforth, T. G. Ingersol, James W. Jones, P. Poilock, Julian Scholl and A. Schaupp.

At a subsequent meeting of the directors the following officers were elected: President, P. Pollock; vice-president, Julian Scholl; secretary and treasurer, James W. Jones; general manager, W. A. Cook.

Hardwood Lagging—Its Applicatons.

Perhaps the principal product falling to machinery broker's hands is boilers and engines, the engine being the greater element of value. A stationary engine may often be secured with but little trouble and at a very attractive price as compared to a new engine. Immediate delivery is also secured and this in a great many instances is an important factor and influences the purchase. As every engine is supplied with some sort of a driving pulley or balance wheel, neither of which may be suited to the purchaser's requirements, a proper driving pulley must be provided. A quick and cheap method of accomplishing the purchaser's needs in this line is found in the applications of the hardwood laggings as manufactured by the Dodge Manufacturing company of Mishawaka, Ind., and shown in the accompanying illustrations.



HARDWOOD LAGGING FOR BALANCE WHEEL.

In the first view is shown a hardwood lagging after its application to a balance wheel

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in the paper mill of the Dells Paper and Pulp company, Eau Claire, Wis. To provide against any possible failure of their water supply, this concern secured a second-hand stationary engine, which was supplied with an 18-foot 15-inch square rim balance wheel weighing 50,000 pounds. As the balance wheel was not suitable for driving purposes, it was either necessary, in order to use the engine, to secure a new driving pulley or lag this old one up. A saving of about 50 per cent. in the cost of exchanging this balance wheel towards the purchase price of a new wheel was made by using the hardwood lagging. It is 44 inches face, being grooved for 18½-inch ropes, and is capable of transmitting 750 horse power. The internal diameter is 18 feet, while its pitch diameter of ropes is 19 feet.

increased by the greater diameter, the speed of rotation remaining the same. The familiar fact of greater co-efficient of friction or driving power of the wood surface over the iron, is also a feature worthy of consideration.

The construction of the laggings is the result of many years of experience and through the use of expensive and special machinery and numerous patented appliances, as well as patents upon the construction as an entirety. After the building up process, which requires a large force of very active and expert men and almost innumerable appliances, powerful presses, etc., the inside of the rim is turned to accurately fit the face of the wheel upon it which is to go, attached to same, and face turned for belt transmission or

HARDWOOD LAGGING RUN READY FOR SHIPMENT.

The second view shows a hardwood lagging rim previous to shipment. The internal diameter of this rim was 14 feet, with 15 feet pitch diameter of ropes. It was grooved for eighteen and one-half-inch ropes for P. & F. Corbin, New Britain, Conn., who desired to transmit the power from one building to another building located on opposite side of the street, which was easily accomplished by the application of the lagging upon the engine fly-wheel and running ropes through a tunnel under the street. This lagging displaced a belt transmission as well.

As the lagging increases the effective diameter of the fly-wheel, linear velocity is grooved for a rope drive, as the case may be. This work and alterations in main drives are made with but little loss of time at small expense, when compared with the cost of new fly-wheels.

A Central Heating Plant at Washington Court House, O.

The Central Station Heating company of Cincinnati, O., has been engaged for about three months in constructing a central heating plant with a capacity for heating 300 houses at Washington Court House, O. The plant will be completed about Feb. 20. This is larger than any other heating plant of which we have knowledge. It can, we un-

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derstand be increased easily to supply six, nine, twelve or more hundred houses. The plant will be operated by the Washington-Smead Hot Water company. President Smead of the Central Station Heating company reports great activity in this line and negotiations in progress for a number of other plants.

The Layman & Parpart Sanitary Street Cleaner.

The general demand for a more satisfactory mechanical method of street cleaning has resulted within the past few years in the construction of numerous machines that more nearly meet the necessary requirements of the work. There are certain well-defined conditions, other than an ability to remove dirt, that must be met by a successful street sweeping machine. It must be simple in construction, economical to operate, sanitary in disposition of the refuse and capable of removing all the dirt. The dust must be retained and the dirt gathered in such a manner to be quickly carted away.

One of the most recent and successful machines for this purpose is owned by the United States Street Cleaning company, No 170 Fifth-ave., New York, N. Y., and is known as the Layman & Parpart sanitary street cleaner.

As shown in the above cut the machine consists of a wagon, the motive power for which can be a horse, electric, steam or other power. The entire arrangement comprises a sprinkler, sweeper, conveyor and receptacle for the dirt. The street is lightly sprinkled from a tank of water located beneath the dirt bin and in advance of the sweeper. The dirt is removed from the pavement by a revolving broom at the rear of the wagon, and is carried by a conveyor to a bin on the wagon with a capacity of two cubic yards, from which it is dumped into a cart or wagon driven alongside. The broom and conveyor are operated by an attachment to the rear wheels.

The broom and conveyor and dirt bin are tightly enclosed and there is no possibility of dirt or dust escaping. The following cut illustrates the method of dumping the dirt from the bin into the carts:

The weight on the wagon remains about constant since the amount of water in the tank decreases as the dirt accumulates. The weight of the empty wagon is about 2,200 pounds. This machine performs the entire operation of sprinkling, sweeping and loading into dump wagon and requires for the work only one team and one man thus making it very economical. The area swept per hour is limited only by the speed with which the machine is propelled.

LAYMAN AND PARPART SANITARY STREET CLEANER.

One man and team can easily clean 70,000 square yards in eight hours. The cleanliness and noiselessness of the machine also allows its use during the day. All portions of the machine, the sweeper, sprinkler and dump are under the complete control of the driver.

The machine has been before the people

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but a short time but its evident adaption to the purpose intended has led to its recommendation by the highest authorities in the engineering and medical professions, while a petition has been presented to the street commissioner of New York, signed by 7,000 prominent business firms, requesting the adoption of the machine for cleaning the streets of that city.

LAYMAN AND PARPART STREET CLEANER, DUMPING.

A Handsome Souvenir.

The Clinton Paving and Building Brick company, Clinton, Ind., J. W. Robb, secretary and manager, is sending to customers as a souvenir a very handsome leather-bound pocket and memorandum book which contains room for all the money the average man will have to carry around with him, in addition to which it has in convenient form facilities for noting memoranda. In connection with the latter some information is given regarding the vitrified shale and paving brick, Clinton block, sewer and sidewalk brick manufactured by the Clinton Paving and Building Brick company, together with a list of the cities and towns classified by years in which this material has been successfully in use.

Recent Inventions.

(Reported especially for MUNICIPAL ENGINEERING by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for ten cents.

662,162. Nov. 20, 1900. Fire-proof Construction. Chas. A. Balph, Pittsburg, Pa. A peculiar centering device for supporting the concrete during course of erection.

662,280. Nov. 20, 1900. Snow Melter. Jacob Mandrey, New York, N. Y. A machine for scraping snow from the street and melting the same.

662,634, 662,635. Nov. 27, 1900. Fire-proof Construction. William White, assnr. one-half to Henry Wiederhold, Philadelphia, Pa. Consists essentially of peculiar constructions of hollow refractory arch members.

662,711. Nov. 27, 1900. Catch-Basin or Fresh Air Inlet. W. H. Dewar, New York, N. Y. A gravity clock valve is placed at the discharge of the basin.

662,808 Nov. 27, 1900. Fire-proof Floor Construction. Michael J. O'Meara, Philadelphia, Pa. A peculiar cross-section for tile members.

663,060. Dec. 4, 1900. Fire-proof Floor Construction. Chas. F. Buente, Pittsburg, Pa. The essential feature consists of the use of hollow refractory centers covered with concrete, and tension rods running through the concrete between the centers.

663,151. Dec. 4, 1900. Apparatus for Applying Sewage to Bacteria Beds. F. A. Barbour, Brocton, Mass., assnr. one-half to F. H. Snow, same place. A series of purification beds each with a float resting upon the liquid, each of said floats controlling both the induction to and eduction from its bed.

663,264. Dec. 4, 1900. Fireproof Construction. William White, Philadelphia, Pa. A series of half-arch blocks, each of which is provided at its inner end with male and female key faces.

663,390. Dec. 4, 1900. Street Sweeper. Chas. Z. O'Neill, New York, N. Y. A street sweeping attachment for wagons, consisting of a rotary brush and an endless elevator carrying buckets, the outer lip of each of which is formed of bristles.

663,484. Dec. 11, 1900. Drawbridge. Thomas R. Bevans, Kalamazoo, Mich. The spans are joined at the center and each is transversely movable along a horizontal track.

663,592. Dec. 11, 1900. Filter. Robert T.

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Weaver, New York, N. Y. A pair of horizontal filter beds arranged one above the other and means for rotating or partially rotating each bed.

663,718. Dec. 11, 1900. Snow Melting Machine. Edward Beatty, New York, N. Y. A portable machine into which the snow may be shoveled from the street.

663,758. Dec. 11, 1900. Street Sweeper. William Hight, Macon, Ill. An attachment for wagons, consisting of a truck carrying a rotary brush and an endless elevator.

663,841. Dec. 11, 1900. Filter. Theodore J. Zoeller, Nashville, Tenn. A shaft carrying a plurality of filter drums and an inclosing reticulated cleansing drum.

663,999, 664,000. Dec. 18, 1900. Concrete Mixer, Samuel P. McKelvey, Chicago, Ill., assignor one-half to O. G. Hurson. A portable machine for mixing paving or sidewalk concrete.

664,024. Dec. 18, 1900. Street Paving, Patrick J. Moran, Memphis, Tenn. A paving in which the surface layer consists of a combination of coarse and hard stone passing through a two and a half-inch ring, a binding material of sand and cement, the portions being three parts of each kind of stone, two of sand and one of cement.

664,039. Dec. 18, 1900. Refuse-Consuming Furnace, William J. Glen, London, Eng.

664,183. Dec. 18, 1900. Ejector for Raising Sewage or Other Liquids, Isaac Shone and Edwin Ault, London, Eng.

664,532. Dec. 25, 1900. Sewage Disposal Apparatus. William L. Church, New York, N. Y. The sewage is discharged intermittently over an apron so formed as to cause the liquid to pass over sinuous courses.

664,705, 664,706, 664,707. Dec. 25, 1900. Tile for Facing Walls. David W. Anderson, Richmond, Va. Each tile is provided with a perforated flange the end of which is set into the wall, an air space being thus formed between the tile and the wall. The outer face of the tile is provided with interlocking grooves for the reception of plaster.

664,861. Jan. 1, 1901. Street Cleaning Roller. Augustin Hentschel, Berlin, Germany. The periphery of the roller is formed of rubber blades.

664,878. Jan. 1, 1901. Street Cleaner. Robert C. Menzies, Glens Falls, N. Y. A two-wheel receptacle-carrier for street cleaners with peculiar means for dumping the receptacle.

665,076. Jan. 1, 1901. System for Collecting Water from Wells. Laurence C. Eisenhut, New York, N. Y. The receiver is provided with a partition and a series of division plates, the inlets lying between the division plates so that the water is discharged directly against the partition to retard the flow and produce sedimentation.

665,317. Jan. 1, 1901. Bridge. David E. Fisher, Kenton, O. Pivoted to each upper corner of the truss is a lever, one end of each of which is attached to an angular end post. The other ends of said levers are connected in pairs by tie rods or cables extending longitudinally of the truss and passing beneath pins carried by an upright strut member thereof.

665,346. Jan. 1, 1901. Filter. Rudolph C. Reed, San Francisco, Cal., assignor of three-fourths to Herman Zadig and H. M. Levy, same place, and Solomon Hirsch, Portland, Ore. The porous filter plates are provided on contiguous surfaces with channels and upon alternate faces with ribs, which form a tortuous channel.

665,406. Jan. 8, 1901. Bascule Bridge. John P. Cowing, Cleveland, Ohio. The fulcrum end of the lifting-span is formed by circular girders to which is secured a series of rollers which form a circular roller-bearing surface which co-operates with an arc-shaped track or cradle concentric therewith.

665,435. Jan. 8, 1901. Apparatus for Purifying Sewage. August H. Heinhold, Wallwitz, Germany. A peculiar arrangement of a deep-drainage filter bed and a series of mixing tanks provided with stirring mechanism.

Reissue 11,882. Jan. 8. 1901. Fire-proof Floor Construction. Michael J. O'Meara, Philadelphia, P. Peculiarly formed transverse members for supporting concrete between structural I beams.

666,078. Jan. 15, 1901. Paving Brick or Block. Henry W. Wanamaker, Baltimore, Md. A composition formed by incorporating two natural clays, the resulting mixture containing silica, alumina, lime, magnesia and iron oxid in proportions which are carefully and very accurately set forth in the claim.

Trade Notes.

ASPHALT.

The Trinidad & Bermudez Asphalt company, Cleveland, O., filed articles of incorporation Jan. 29. The incorporators are: C. W. Warner, president; P. R. Quinlan, F. E. Cole, M. F. Bramley and John B. Cowing.

The Standard Asphalt company has removed its office from the Crocker building, San Francisco, Cal., to room 2, Bryson block, Los Angeles, Cal.

The Cranford Paving company, Washington, D. C., elected directors Jan. 8 for 1901, as follows: L. S. Filbert, J. H. Cranford, T. M. Gale, J. M. Wilson, H. H. Parmenter, Thomas Kirby and Percy Cranford. Officers were elected as follows:

President and Treasurer—J. H. Cranford.
Vice-President—Percy Cranford.
Secretary—H. S. Houghton.

BRICK.

The Boonville Vitrified Brick & Tiling company, Boonville, Mo., has been incorporated by O. D. Edwards, Louis C. Nelson, A. C. Jacobs, W. Speed Stephens and B. M. Proetz.

A vitrified paving brick plant will be located in Crawfordsville, Ind. The Poston block, which has been manufactured at Veedersburg for several years, will be manufactured by the company. Mr. Poston, who patented the block, resides in Crawfordsville. The company will be capitalized at $100,000 and will employ about fifty men at the start.

CEMENT.

A cement plant is being erected near Schoolcraft, Mich., in which Douglass & Sellers of Battle Creek are interested. The machinery has not yet been contracted for.

The H. B. Camp company, Akron, O., has plans for a new cement plant, which will cost about $30,000.

W. R. Loranger of Bay City, Mich., and

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Julius Stroh of Detroit are interested in a scheme to locate a Portland cement plant in Bay county. Plans are being made for the buildings and a company will soon be organized.

The directors of the sixteen cement mills in Clark county, Indiana, met Jan. 23 and an agreement was reached by which all the plants except one, the Indiana Cement mill at Charlestown, Ind., will form themselves into a combination, known as the Western Cement company, with headquarters in Louisville. Prices will be adjusted on a higher scale.

The Buckhorn Portland Cement company, which had a plant under course of construction at Manheim, near Rowlesburg, W. Va., has made an assignment. Abram C. Mott of Philadelphia was appointed receiver, and empowered to borrow $110,000, if necessary, with which to complete the plant.

The Cayuga Lake Cement company has been incorporated by Charles C. Lee of Binghamton, N. Y., as president; M. E. Calkins, Ithaca, vice-president; C. E. Freeman, Ithaca, secretary. The selling office of the corporation will be in Binghamton. The plant will cost about $200,000, and electrical apparatus to the amount of $40,000 will be installed.

J. Keith Fisher of the British Columbia Portland cement company at Vancouver, has organized a company of American capitalists to establish extensive cement works, according to press reports.

The Consolidated Cement company of Milwaukee contemplates the improvement of its plant north of Whitefish Bay, Wis., at a cost of $25,000.

The Frank C. Morse company, 17 State-st., New York City, states that the Dragon Portland cement has been used in the vicinity of New York City as follows: Century building, Seventy-ninth-st. and West End-ave.; Yale club building, Forty-fourth-st., between Fifth and Sixth avenues; Settlement house, Fiftieth-st. and Tenth-ave.; Hartel building, Forty-first and Forty-second-sts., between Sixth-ave. and Broadway; Model tenements, Forty-second-st. and First-ave.; One Hundred and Eighty-second-st. and Madison-ave.; and Thirtieth-st. and Twelfth-ave.; schools at One Hundred and Second-st., Columbus and Amsterdam-aves., Hubert and Collister-sts., One Hundred and Eighth-st. between First and Second-aves., and One Hundred and Fifth-st. between First and Second-aves. The contractors using the cement are as follows: Marc Eidlitz & Son, Andrew J. Robinson Company, M. Caravatta, John Sweatt, William Hilgers Company, McKnight Flinter Stone company, Petriwski & Keller company.

The Indiana cement company has filed a certificate at Trenton, N. J., increasing its capital from $1,500,000 to $5,000,000. R. H. Evans, president; V. C. Faulk, secretary.

J. T. Haynes, formerly of the Garden City cement company, has opened an office at 317 Chamber of Commerce, Chicago, where he will represent the Kelley island lime and cement company of Cleveland, Ohio.

The Alsen's American Portland Cement Works company has been incorporated in New Jersey to manufacture cement for the American market. The incorporators are H. Wessel, W. Willons, H. Baasch, H. Hick, A. C. Babson and R. S. Sinclair. The new plant will be located at West Camp. The contract has been awarded to John W. Ferguson of Paterson, N. J., after plans by Lathbury & Spackman, engineers, of Philadelphia. The company will conduct the business heretofore carried on by the Alsen's Portland Cement Works company, which was controlled by a German corporation and represented in New York City by Babson & Sinclair.

The Vulcanite Portland Cement company has established an office at 317 Chamber of Commerce Bldg., Chicago, with Geo. W. DeSmet as Western sales agent.

A cement plant is proposed at Salt Lake, to be located in Parley's Canyon, Utah.

The New England Portland Cement Co., has been organized with main office in Jefferson Co., W. Va.

The capacity of the plant of the Omega Portland Cement Co., Jonesville, Mich., will be increased, and new machinery, including power, and five rotary kilns will be desired.

The Twentieth Century Portland Cement Co., Fenton, Mich., has been incorporated with C. L. Corrigan as secretary, and J. C. Edsall as general manager.

The Wayland Portland Cement Co., has been incorporated by F. J. McGrae, Daniel P. Collins, Charles E. Hoffman of Jersey City, N. J.

ELECTRIC LIGHT COMPANIES.

Articles were filed Dec. 20 at Trenton, N. J., merging the Raritan Electric Light and Power company, the Bound Brook Electric Light, Heat and Power company, the Dunellen Electric Light company, the Edison Electric Illuminating company of New Brunswick, the Railway Electric company and the Middlesex Electric company into the Central Electric company. The officers of the consolidated company are: President, Philip N. Jackson; vice-president, Adrain Riker; secretary, L. D. Howard Gilmour; treasurer, Uzal H. McCarter, all of Newark.

The Wenonah, Glassboro & Clayton Electric company has been incorporated, with main office at Putnam Grove, Pa., by Jacob P. Shannon of Philadelphia, and Casimir W. and Elmer H. Boynton of Middlesex county.

The Ossining Heat, Light and Power company, Sing Sing, N. Y., has been incorporated to manufacture and supply gas for heat, light and power in Sing Sing and Croton and manufacturing electricity for the same purpose.

The La Grange Gas company, La Grange, Ill., has been incorporated to operate a gas plant, by Benjamin F. Alschuler, John K. Newhall and E. Hinckle.

The Bellows Falls Electric Light company, which was incorporated in Maine, has reorganized under the laws of Vermont and will be known as the Falls Mountain Electric Light and Power company. It will supply electricity for light, heating and power at Bellows Falls and Westminster, Vt., and Walpole and Charlestown, N. H., and surrounding towns.

The Leachville Electric Power company has been incorporated and will build at once a large plant to furnish light and power to Leachville. The incorporators are George C. Manly and Sons, H. Tatum of

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Denver, Col., and Edward S. Douglas of Tampa, Fla.

The Connecticut Electrical company, New Haven, Conn., made an assignment Jan 5.

It is believed that the Louisville Gas company, the Kentucky Heating company, the Louisville Electric company and the Citizens' General Electric company, Louisville, Ky., will be consolidated, Allen Odell, New York City, is promoter of the scheme.

Newly incorporated companies: Ssunset Electric Light and Power company, San Francisco, Cal.; Plymouth Electric Light company, Plymouth, Ind.; Chestertown Electric Light and Power company, Chestertown, Ind.; Bellows Falls Electric Light company; Hinton Light, Ice and Fuel company, Hinton, W. Va.; Cambridge City Light and Power company, Cambridge City, Ind.; San Bernardino Gas and Electric company, San Bernardina, Cal.

SEWER PIPE.

The caving in of the crown of a kiln at the Bennett Sewer Pipe company's plant, Jackson, Mich., recently, caused a loss of $2,000.

The Wood Sewage Utilization and Contracting company has been incorporated with main office in New York City, to conduct contracting business and build sewers. The incorporators are Robt. H. Bohn, John F. Zebley, Benjamin F. Dalton, John A. Fiske, John K. Millis, Clarence Delafield and Frederick F. Maronand of New York City.

MISCELLANEOUS.

A plant is being built at Central-ave. and Thirty-second-st., Los Angeles, Cal., by the Pacific Electrical works, for the manufacture of insulated wire, and it is thought that it will be in operation by Feb. 1. The officers of the company are; President, Wallace L. Hardison; vice-president, Guy L. Hardison; secretary, Frank Taylor; treasurer, Lewis W. Andrews.

Sealed bids are asked at Indianapolis, Ind., until Feb. 8 for furnishing a complete modern central office equipment for the fire alarm telegraph system. Nelson J. Hyde, chairman Board of Public Safety.

The Morava Construction company, Chicago, Ill., has been incorporated and will erect a bridge building plant on the Western Indiana Belt railway, near Eighty-fourth-st.

The Conshohocken Stone company of Philadelphia, has been incorporated under the laws of Delaware to mine, quarry and deal in and work stone.

The Keeling & Ridge company, Camden, N. J., has filed articles of incorporation and will build bridges.

The Windsor Paving company, composed of Andrew M. Eastwick, Herbert Geshwind and Edwin Hall, have dissolved partnership and Messrs. Eastwick and Geshwind have formed the general contracting and paving firm of Eastwick and Geshwind.

The Interstate Electrical Wire Subway company, Kansas City, Mo., has been incorporated by W. S. Woods, William Huttig and Joseph J. Heim.

The National Contracting company, Jersey City, N. J., has been incorporated to contract bridges, by H. C. Kennedy, S. H. Stuart and K. K. McLaren.

The American Bridge company of New York, with principal offices in New York City, has been incorporated with directors as follows: Herbert Wright, Henry Schoonmaker and John P. Tuomey of Brooklyn; W. De Saussure Trenholm, Robt. Walker, Joseph P. Colton, jr., and Wm. L. Ball, New York City.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Sydney, Australia—A cycle path, nearly two miles long and having a uniform width of ten feet has been completed in this city.

Sioux City, Ia.—Formal objections have been filed with the city clerk by the property-owners, who are protesting against the new special assessment law.

Milwaukee, Wis.—The report of City Engineer Poetsch shows that during 1900 the cost of paving was as follows: Brick, 1,227 miles, $65,000; asphalt, 4.35 miles, $250,801; stone, 0.121 mile, $9,016. The city also laid during the year 7.63 miles at a cost of $75,747.

Nashville, Tenn.—A resolution has been adopted authorizing the appointment of a committee to investigate the question of purchasing all the turnpikes in the county and making them fine roads. The committee is composed of C. B. Harwood, W. C. Dodson, L. C. Hessey and J. B. Whitsett.

St. Paul, Minn.—The report of City Engineer Claussen for 1900 shows that during the year the following work was accomplished: Paving, 4½ miles; cement walks, 17.300 miles; sewers, 4.09 miles; manholes, 85; catch basins, 33; grading streets and alleys, 1.36 miles; cycle paths, 5 miles.

Seattle, Wash.—The use of Kettle river sandstone for paving heavy traffic streets is favorably referred to by City Engineer Thomson and Superintendent of Streets Little, in their report to the city council. They call attention to its toughness, which causes it to wear flat and not spall.

Toledo, O.—A new system to regulate the awarding of paving contracts in this city is proposed, which provides that a foot frontage majority petition, filed before bids for paving a street are opened, shall determine the material to be used in paving; that no later petition be considered at all; that in case no majority petition is filed the committee shall award the contract to the lowest bidder.

Weeping Water, Neb.—The Republican invited communications in December from professional and business men and women, on the improvements most urgently needed, in their estimation, to make this a better town. Among the improvements most urgently advocated were the following; paving

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the principal streets; paving sidewalks with brick; building a town hall of brick; electric light plant; increasing the water supply.

CONTEMPLATED WORK.

Freeport, Ill.—Street paving is proposed.

Petosky, Mich.—Paving is contemplated this spring.

Topeka, Kas.—The paving of Western-ave. is proposed.

Findlay, O.—Paving is contemplated for N. Cory-st.

Elkhart, Ind.—Brick paving is proposed for Beardsley-ave.

Seattle, Wash.—Brick paving is proposed for Occidental-ave.

Brooklyn, N. Y.—Asphalt paving is desired for DeKalb-ave.

Passaic, N. J.—Bergen-st. will be graded, curbed and guttered.

Bay City, Mich.—Paving will be recommended for a number of streets.

Albert Lea, Minn.—The question of street paving is being agitated.

Eufaula, Ala.—The question of paving Broad-st. is being agitated.

Helena, Mont.—The question of paving Main-st. is being discussed.

Rockford, Ill.—National-ave. will be macadamized its entire length.

Indianola, Ia.—Paving is urged for the public square and side streets.

Bowling Green, O.—The question of street paving is being discussed.

Atlanta, Ga.—The sum of $5,000 will be appropriated for paving Peters-st.

Durham, N. C.—This city voted Jan. 8 to issue bonds for street improvements.

Fairfield, Ia.—The question of paving the public streets is being agitated.

Coshocton, O.—A petition is being circulated for paving Cherry-st. with brick.

Fitchburg, Mass.—Bonds for street and sidewalk improvements have been sold.

St. Louis, Mo.—Ordinances have been passed for paving Nineteenth-st. with brick.

Saginaw, Mich.—Plans have been approved for improving Washington-ave. and Perry-st.

Terre Haute, Ind.—A petition is being circulated for brick paving on S. Fourth-st.

Jacksonville, Fla.—Ordinances have been passed for paving several streets with brick.

Chicago, Ill.—Asphalt walks are contemplated for the campus of the University of Chicago.

Woodbury, N. J.—The board of freeholders has decided to construct three new roads.

Los Angeles, Cal.—An ordinance has been passed for paving Pico-st. C. H. Hance, cy. clerk.

Oakland, Cal.—Union and Howard-sts. will be paved and graded. A. S. Newburg, cy. clk.

Joplin, Mo.—A resolution has been passed providing for asphalt paving in S. Main-st.

Toronto, Ont.—Asphalt paving has been recommended for King-st., and macadam for Parliament-st.

La Crosse, Wis.—A new ordinance for street paving has passed second reading. Mayor Anderson.

Montgomery, Ala.—Bids will be received about March 1 for road improvements. J. M. Garrett, co. engr.

Peoria, Ill.—Brick paving is contemplated for St. James-st., from Elizabeth to University.

Minneapolis, Minn.—The question of paving Washington and Twentieth-aves. is being considered.

Niagara Falls, N. Y.—The city clerk has been directed to ask for bids for paving Buffalo-ave.

White Horse, N. W. T.—The feasibility of constructing a wagon road to the Big Salmon is being considered.

Macon, Ga.—The citizens on Spring and Walnut-sts. have petitioned for the paving of that thoroughfare.

Conneaut, O.—A petition is being circulated for paving lower Harbor, Broad, Buffalo and Sandusky-sts.

Springfield, Mo.—A resolution of intention has been passed to pave Clifton-st. with brick or block.

Pittsfield, Mass.—The question of paving North and West-sts. has been referred to a special committee.

Napa, Cal.—A resolution of intention has been passed to macadamize Calistoga-ave. H. H. Thompson, clk.

Akron, O.—City Engineer Payne has been directed to prepare plans for paving Grant and E. Market-sts.

Baltimore, Md.—Ordinances have been passed for paving Montford-ave. with brick and Bayard-st. with asphalt block.

Braddock, Pa.—The question of issuing $8,500 bonds for street and sewer improvements will be voted on Feb. 19.

Portsmouth, Va.—The council has authorized an issue of $50,000 bonds for street improvements in the Fifth ward.

Denver, Col. — Sherman-ave., between Eighth and Fourteenth-aves., will be paved with disintegrated granite this year.

Toledo, O.—The property-owners in Greenwood-ave., from Oak to Yondotega-sts., want the street paved with asphalt blocks.

Syracuse, N. Y.—The council has decided to pave Warren, Willow, Canal, Pearl and W. Jefferson-sts. R. R. Stuart, cy. eng.

Cincinnati, O —City Engineer Stanley has been authorized to prepare plans and specifications for paving Beckman-st. with granite.

Newark, N. J.—The city surveyor has been authorized to prepare estimates for paving certain streets in East Newark with brick and asphalt.

East Orange, N. J.—The sub-committee has reported favorably regarding the improvement of Bedford-st. Objections will be heard Feb. 11.

Canton, O.—W. Second, Third and Fourth-sts. will probably be paved.

Cincinnati, O.—The board of public service has decided to construct asphalt and granite boulevards on Mt. Adams.

Cincinnati, O.—A resolution has been passed to pave Gilbert-ave. with brick. Robert Allison, pres. B. P. S.

La Crosse, Wis.—Petitions are being circulated asking that a number of streets be paved with brick this year.

Syracuse, N. Y.—Plans and specifications for paving Gifford-st. will be prepared by R. R. Stuart, cy. eng.

Atlanta, Ga.—The citizens of the Fourth ward are urging council to complete the asphalt paving on Edgewood-ave.

New Ulm, Minn.—An ordinance is proposed requiring that cement walks replace the present walks as rapidly as possible.

Topeka, Kas. — Plans and specifications

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are being prepared by the city engineer for paving and building sidewalks.

Goshen, N. Y.—The issue of $200,000 bonds for road improvements has been authorized by the board of supervisors.

East Orange, N. J.—A petition has been presented to council asking that Bedford-st. and Elwood-ave. be macadamized.

Dallas, Tex.—The question of voting on the proposed issue of $200,000 bonds for road improvements is being considered.

St. Paul, Minn.—The question of paving Rosabell-st. with Kettle river sandstone is being considered. C. H. Bronson, clk.

Baker City, Ore.—The question of paving Main-st. with asphalt, vitrified brick or wooden blocks is being considered.

Birmingham, Ala.—Mayor Drenen says that nearly $500,000 will be expended during 1901 for paving and improving the streets.

Washington, D. C.—A bill has been introduced in the senate providing for the paving of Columbia road west of Fourteenth-st.

E. Liverpool, O.—This city has decided to pave Pennsylvania-ave. with brick instead of macadam. John A. George, cy. eng.

St. Joseph, Mo.—An ordinance was passed Jan. 22 providing for asphalt paving on Ashland-ave., to the city limits, one-half mile.

Woodbury, N. J.—The estimated cost of constructing a stone road on Delaware-st., to the intersection of Crown Point road, is $8,900.

Davenport, Ia.—The question of improving Bridge-ave., paving Fifteenth-st., and grading Kirkwood boulevard, is being considered.

Brooklyn, N. Y.—Highway Commissioner Keating has been authorized to pave with asphalt portions of Sixth and Seventh-aves. and Manhattan-st.

New Philadelphia, O.—The council has given notice of intention to pave portions of Broadway and High-sts. and East-ave. with brick.

Riverside, Cal.—Asphalt paving is being discussed for a number of blocks of streets in the center of the city. Joseph W. Johnson, cy. engr.

Bonds for street improvements have been sold as follows: Carnegie, Pa., $10,000; Petersburg, Va., $75,000; Montgomery, Ala., $100,000; Cherry Hill, N. J.

Dickinson, N. Y.—Plans and specifications for about 9,000 feet of road in this town have been prepared by H. C. Allen, city engineer of Syracuse.

Avalon, Pa.—Ordinances have been passed for improving Taylor, Florence and Riveraves. E. E. Custard, clk, of coun.; J. S. Dailey, burgess.

Memphis, Tenn.—The legislative measure authorizing an issue of turnpike bonds to the amount of $150,000 has been adopted by the county court.

Plattsburg, N. Y.—The county board of supervisors has voted $13,300 for the building of three miles of road. This is one-half the amount required.

Buffalo, N. Y.—The council approved, Dec. 26, the five-year repair proposition of the various asphalt companies, which has been pending since July 11.

East Orange, N. J.—An ordinance has been introduced for grading, curbing and paving Bedford-st., between Elmwood-ave. and Vailsburg line, with Telford.

Peoria, Ill.—Estimates were submitted Jan. 9 for paving Randolph-ave., from North to Chambers, with asphalt, and Water-st., from Main to Chestnut, with brick.

Cairo, Ill.—An ordinance providing for grading and graveling Twenty-seventh-st., from Washington-ave. to Walnut-st., has been referred to the ordinance committee.

Duluth, Minn.—Estimates have been submitted by City Engineer McGilvray for paving Superior-st., from Eighth-ave. to Twenty-third-ave., E., with block and sheet asphalt.

Bay City, Mich.—The residents of Midland-st., from Center-st. to Euclid-ave., and Center-st., from Midland to Ohio-st., have petitioned for brick, asphalt or asphalt block paving.

La Crosse, Wis.—The board of public works has recommended the paving of twenty-five blocks of street with brick. The property-owners in the residence portion will ask for paving.

St. Paul, Minn.—The council will require the Union Depot company to grade, pave and build sidewalks around the depot, in consideration of vacating certain streets for the company.

Woonsocket, R. I.—The street department has asked for an appropriation of $39,000 for improvements and for paving Clinton, N. Main, Social and Cumberland-sts. with macadam.

Milwaukee, Wis.—A resolution is pending in council which provides for paving Cedar-st., from Fifth to Sixth with asphalt, and for macadamizing Sixth-st., from Cedar to State.

Bristol, Va.—A committee of five was appointed from the Virginia council, Jan. 4, to confer with the Tennessee council regarding the paving of Main-st., between the two cities.

South Bend, Ind.—The residents of this city and of Mishawaka contemplate the construction of a boulevard 100 feet wide between the two cities; estimated cost, $50,000. L. A. Hull, cy clerk.

Vicksburg, Miss.—The survey for the main roadway for the new National military park has been completed. It will be about eight miles long and will have four iron bridges. W. T. Rigby, com.

Sioux City, Ia.—John Erickson, city street commissioner, recommends the construction of forty miles of brick, cement and stone walks during this year to take the place of wood and other unimproved walks.

Lakewood Hamlet, O.—(Special.)—R. J. Wood, engr., has been instructed to prepare plans, profiles and specifications, for paving Clifton boulevard, and bids will be asked on asphalt, brick and macadam.

West Hoboken, N. J.—The township committee of North Bergen decided recently to grade, build sidewalks and otherwise improve Smith-ave. and Danielson-st. Emil J. Foerch, twp. clerk; Chas Dietz, chairman com.

San Francisco, Cal.—Specifications have been approved for paving Sacramento, Clay and Washington-st., between Montgomery and Sansome-sts., with asphalt or bituminous rock on concrete; estimated cost, $6,633.

Grand Rapids, Mich.—Estimates have been prepared for contemplated street improvements as follows: James-st., macadam; N. Union-st., creosoted wood block, asphalt

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block and asphalt; W. Leonard-st., brick; Madison-ave., gravel.

New York City—Mayor Van Wyck has approved paving ordinances as follows: Stanhope-st., Wyckoff-st. to St. Nicholas-ave., asphalt; Linden-st., Hamburg and Knickerbocker-aves., granite block; Chauncey-st., Rockaway-ave. and Broadway, asphalt.

Grand Rapids, Mich.—Resolutions were introduced Jan. 14 for grading and graveling portions of Eureka-ave. and Phillips-st. The question of paving N. Union-st. with asphalt or creosoted wood blocks is being agitated.

Trenton, N. J.—Ordinances were passed Jan. 4 for paving S. Broad-st., from Chestnut-ave. to Liberty-st., with asphalt on concrete, and State-st., from N. Willow-st. to the D. & R. Canal, with asphalt over Belgian block. C. E. Murray, cy. clk.

Hamilton, O.—Estimates have been completed for paving Court, B and Dayton-sts. and Ross-ave. with asphalt, asphalt block and vitrified brick. Plans, specification and estimates will be submitted for paving N. Seventh st. Cy. Eng. Dillon.

St. Joseph, Mo.—The county court has under consideration a proposition to macadamize Ashland-ave., from the east city limits to Oakland cemetery, one-third mile. An ordinance has already been introduced in the council providing for paving the avenue from Frederick-ave. to the city limits with asphalt.

Albany, N. Y.—Plans have been prepared for constructing a large number of roads, and have been accepted by the boards of supervisors of various counties. The counties' shares of the expense have been appropriated and as soon as the legislature makes the state's share of the appropriation bids will be advertised and contracts awarded.

Seattle, Wash.—An ordinance has been passed providing for concrete walks, wood curbs, gutters and crosswalks on Eighteenth-ave., from E. Columbia to E. Howell-st. Ordinances have been passed for grading and planking 12 streets. The street committee has recommended asphalt paving with concrete curbs and brick gutters for Madison-st., from Terry-ave. to Broadway. W. V. Rinehart, prest. cy. com.

Indianapolis, Ind.—The question of street improvements in this city depends largely upon the course taken by the legislature in regard to amending the Barrett law. Among the improvements needed are the following: Meridian and Illinois-sts., from Fall creek to Thirty-fourth-st.; portions of E. Tenth, W. Tenth, W. Washington, Shelby, Bellefontaine, Ohio and the unimproved portions of Merrill-st.

Seattle, Wash.—Estimates have been submitted for the contemplated improvements, as follows: Grading and walks, Virginia-st., from Fourth-ave. to Denny way, $8,850; cement walks, Thirtieth-ave., S., from Yesler to Dearborn, $5,200; grading E. Thomas-st., $4,250; grading First-ave., N., $5,900; grading E. Fir-st., $3,550; grading E. Thomas and E. John-sts., $4,500. Vitrified brick paving is proposed for Occidental-ave., from Yesler way to the King-st. coal bunkers.

CONTRACTS TO BE LET.

Lake Geneva, Wis.—Bids are asked until Feb. 6 for furnishing 200 cu. yds. of gravel. C. H. Gardner, cy. clerk.

Greensburg, Ind.—Sealed bids are asked until Feb. 1 for paving the walks on Broadway with brick. Wm. R. Brazelton, cy. clerk.

Cincinnati, O.—Sealed bids are asked until Feb. 15 for paving Dayton and McKeon alleys with brick. Robt. Allison, prest. bd. pub. service.

Bedford, Ind.—Sealed bids are asked until March 4 for constructing gravel and macadamized roads in Shawswick twp. John M. Gainey, co. audt.

Marion, Ind.—Sealed bids are asked until Feb. 20 for macadamizing and asphalting the Home boulevard in Center twp. Paris Hoover, chmn. bd. co. com'rs.

Houston, Tex.—Bids are asked until March 4 for paving Congress-ave. with asphalt, vitrified brick or macadam. S. H. Brashear, mayor. I. A. Miller, cy. eng.

Columbus, O.—Sealed bids will be received until Feb. 7 for reflooring the roadways and sidewalks of the Grand View-ave. bridge over the Scioto river, Franklin twp. L. E. Jones, co. audt.

Atlantic City, N. J.—Sealed bids are asked until March 6 for constructing a gravel road from May's Landing to Pleasantville, a distance of twelve miles. John T. Irving, dir., Elwood. John J. Albertson, engr., Magnolia.

Cincinnati, O.—Sealed bids are asked until Feb. 7 for macadamizing Observatory-ave. Robt. Allison, prest. bd. pub. service. Sealed bids will be received until Feb. 2 for improving Blue Ash-ave., Sycamore twp. E. L. Lavis, co. audt.

Ripon, Wis.—Sealed bids are asked until Feb. 20 for curbing, protection curb, vitrified brick paving, iron gutter bridges, wood gutter bridges and cast iron gutters for carrying water under the street crossings. O. C. Stickles, chmn. bd. pub. wks.

Toledo, O.—Sealed bids are asked until Feb. 4 for paving Glenwood-ave. and an alley with vitrified brick or Kreodone creosoted blocks. Sealed bids are asked until Feb. 15 for paving Field-ave. and Vance-st. with vitrified block or Kreodone creosoted blocks. J. E. Connell, cy. clk.

Atlanta, Ga.—Sealed proposals are asked until Feb. 4 for furnishing and setting tile sidewalks and cement curbing, stone curbing, brick sidewalks, relaying granite block pavements, furnishing cement, broken stone and chert. H. P. Collier, com. pub. wks. R. M. Clayton, cy. eng.

CONTRACTS AWARDED.

Washington, D. C.—A contract for 50,000 feet of stone paving has been awarded to W. H. & S. H. Venable.

Gainesville, Fla.—The contract for constructing a stone road was awarded to D. G. Edwards of Micanopy, for $3,080.

Seattle, Wash.—The contract for cement walks on Broadway, from Yesler-way to Roy-st., was awarded to F. McLelland for $23,427.

Indianapolis, Ind.—The contract for graveling the roadway and building sidewalks on Raymond-st. has been awarded to George W. McCray.

Tampa, Fla.—W. L. Spitler submitted the lowest bid, Jan. 16, for 17,850 square yards of brick paving and 8,468 lineal feet of granite curbing at $30,000.

York, Pa.—The contract for laying arti-

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ficial stone pavements on Springetsbury-ave., from George to Water-sts., was awarded to Frank L. Lehman & Co.

Toledo, O.—The contract for paving George-st., from Cherry to Locust-sts., with Nelsonville block, has been awarded to George H. Cole for $4,396.90.

Louisville, Ky.—Contracts for vitrified block paving in a number of streets has been awarded to George W. Gosnell and L. R. Figg, at a total cost of $60,000.

New Orleans, La.—J. A. Craven & Co. secured the contract for paving a roadway with square blocks, at 64 cents a square yard; new curb, 42 cents a square foot. Total, $1,396.80.

Birmingham, Ala.—Donelson & Calvin were awarded a contract Jan. 16 for paving Huntsville-ave. with chert at $1.05 a sq. yd., or $6,658. Bids were received for macadamizing a number of other streets and paving various sidewalks.

Cedar Rapids, Ia., (Special)—The contract for 18,000 yds. of asphalt paving on Fifth-ave. and Division-st. was awarded Jan. 4 to the R. F. Conway company of Chicago, at $1.69 a sq. yd., for paving, and 50 cents a lineal foot for curbing; total, $33,220. The Barber Asphalt Paving company bid $1.76, and the Bermudez Asphalt Paving company $2.02.

Rochester, N. Y.—Contracts were awarded Jan. 4 for repairing the asphalt streets as follows: Rock Asphalt company, streets paved with rock asphalt, $1.57 a sq. yd. without concrete, and $2.36 with concrete. Whitemore, Rauber & Vicunus all other asphalt paved streets, $1.65 without concrete, and $2.50 with concrete.

Toledo, O.—Bids were received Jan. 7 for 4,370 sq. yds. of paving on Indiana-ave., as follows: Warren Scharf Asphalt Paving company, Trinidad pitch lake asphalt, $2.42 a sq. yd; Athens block, Buckeye block and Harris pavers, $1.80 on concrete and $1.50 on sand. Garrigan Bros., Athens, Buckeye, Medal, Met., Nelsonville and Perkins blocks and Harris pavers, $1.60 on concrete and $1.40 on sand; Logan block, $1.55 on concrete and $1.35 on sand; Kreodone creosoted block, $2.60 and $2.40; asphalt block, $2.39. Kirlin Bros., Athens, Buckeye, Medal, Met., Nelsonville and Perkins blocks and Harris pavers, $1.65 and $1.30; Logan block, $1.64 and $1.29. C. H. Burchenal, asphalt block, $2.24. William J. McMahon, $1.60 and $1.20 for block pavements, on concrete and sand respectively; asphalt block, $2.20. Barber Asphalt Paving company, block pavements, $1.75 and $1.50; Trinidad pitch lake asphalt, $2.40.

SEWERS.

South Bethlehem, Pa.—The South Bethlehem Sewerage company has been incorporated.

Galveston, Tex.—Dr. C. H. Wilkinson, city health physician, advocates municipal ownership of the sewerage system.

Dallas, Tex.—The municipal government contemplates testing its rights under the city ordinances and constitution to compel property-owners to connect with the city sewers.

Columbus, O.—A committee composed of Dr. Probst, Dr. Crossland and Dr. Warner, members of the state board of health, visited several eastern cities recently for the purpose of inspecting sewage disposal systems. The cities visited were Worcester and Lowell, Mass., Providence and Pawtucket, R. I.; New York City and Albany and other cities.

Philadelphia, Penn.—A big concrete sewer has been constructed to connect with the McKean-st. sewer at Swanson-st. It is an experiment in engineering and as such has attracted the attention of engineers in all parts of the country. The whole interior is constructed of cement held together by steel girders and rests on a platform of stone.

CONTEMPLATED WORK.

Dexter, N. Y.—A sewerage system is contemplated.

Mt. Sterling, Ky.—A sewerage system is contemplated.

Flushing, L. I., N. Y.—A 20-ft. trunk sewer in Newtown is proposed.

Celina, O.—The question of constructing a sewerage system is being agitated.

Hartford, Conn.—Bids will be asked soon for building a sewer in Wadsworth-st.

Pittsburg, Pa.—Ordinances have been adopted for sewers in a number of streets.

Centralia, Ill.—The construction of a sewerage system is urged by the press.

Olathe ,Kas.—An ordinance was adopted Jan. 15 for a sewerage system. Mayor Hodges.

Columbus, Ga.—The present sewerage system is inadequate and a new system is proposed.

Newark, N. J.—Plans for the Central relief sewer have been completed and bids will be asked soon.

Normal, Ill.—An 8-in. pipe sewer in Mason-st. and a 15-in. sewer in Fell-ave. are proposed.

Mt. Sterling, Ky.—The question of building a sewerage system is said to be an important one.

Chattanooga, Tenn.—A sewer is proposed on Vulcan-st., between Whiteside and Milliane-sts.

Hagerstown, Md.—The question of building a sewerage system is being considered by the sewerage commission.

Huntington, L. I., N. Y.—The question of sewer construction is being considered by the property-owners.

Wakefield, Mass.—Plans are being prepared for a sewerage system. Orlando K. Morgan, engr., sewer com.

Milwaukee, Wis.—The council has recommended the appropriation of $88,000 for sewer work this year.

Waterbury, Conn.—Sewers are proposed for Cottage-place, Hill and Hopkins-sts.; Cy. Engr. Cairns.

Circleville, O.—An ordinance has been introduced providing for a main sewer. Mayor Row.

Belleville, Ill.—The city council is considering the question of constructing the Richland creek sewer.

Fitchburg, Mass.—Plans for a sewerage system are being prepared by Freeman C. Coffin of Boston.

Haddonfield, N. J.—Efforts are being made by two rival companies to obtain a franchise for a sewerage system.

Swissvale, Pa.—An ordinance has been passed to increase the bonded debt $105,000 to build a sewerage system.

Brockton, Mass.—The sewerage commis-

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sioners will ask for an appropriation of $35,000 for sewer work this year.

Findlay, O.—Bids will be received Feb. 7 for the purchase of $16,000 sewer bonds. Frank C. Ray, city clerk.

Columbus, O.—An ordinance has been adopted for constructing three pipe sewers. John L. Barr, cy. clk.

Braddock, Pa.—The question of issuing bonds for sewer and street improvements will be voted on Feb. 19.

Winona, Minn.—The city engineer has been directed to devise a storm water drainage system and to prepare plans and profiles.

Lestershire, N. Y.—The question of constructing a sewerage system and a new reservoir is being considered.

Merchantville, N. J.—Plans for a sewerage system have been prepared by F. A. Dunham, C. E., of Plainfield, N. J.

Pasadena, Cal.—A resolution has been passed for building sewers in Kensington-place, Vernon and Millard-aves., and Mary-st.

Bozeman, Mont.—An ordinance is pending in the city council which provides for a comprehensive sewerage system.

Springfield, O.—Plans and estimates are being prepared for the Main-st. sewer which will be 4,800 feet long.

Newport News, Va.—The citizens of the North End have asked the council to construct a sewerage system in that section.

Buffalo, N. Y.—City Engineer Bardol has prepared for plans for a forty-five-inch sewer across Cazenovia Park; estimated cost, $87,000.

Middleboro, Mass.—The council will ask the legislature for authority to issue bonds for constructing a system of sewage disposal.

Dexter, N. Y.—The citizens are agitating the question of building sewerage and water works systems and an electric light plant.

Binghamton, N. Y.—Rudolph Hering of New York City has been engaged as consulting engineer on the proposed sewer extensions.

Waukegan, Ill.—The construction of a drain on W. Worthington-st., from the ravine to Buttrick-st., is proposed. Engr. Bowen.

Weehawken, N. Y.—The construction of a sewage pumping station for the lower section of the town is favored by Twp. Engr. Bond.

Riverside, Cal.—The city engineer has been directed to prepare plans for the extension of the Arroyo sewer, and for a sewer in block 3, range No. 3.

West Hoboken, N. J.—Plans for the construction of a southern outlet sewer, to connect with the proposed new Hoboken sewer, are under consideration.

Richmond, Va.—The street department will ask for an appropriation of $800,000, the greater part of which will be used for the proposed sewer extensions.

Seattle, Wash.—Plans and specifications have been approved for a sewer on Nineteenth-ave. 2,000 feet long and for a sewer on Eighth-ave.

East Providence, R. I.—The East Providence Sewer company, recently incorporated, will ask for a franchise for building a sewerage system for this city.

New Albany, Ind.—A syndicate has applied for a franchise for constructing a complete sewerage system in this city according to local press reports.

Camden, N. J.—Ordinances have been passed for the construction of an underground drain or culvert on Second and Cherry-sts. H. C. Kramer, clk. coun.

Minneapolis, Minn.—In his annual report City Engineer Sublette calls attention to the necessity of extending the sewerage system.

Collingwood, O.—A resolution was adopted Jan. 22 for constructing drains in sewerage and drainage district No. 2. O. Jenkins, mayor. L. A. Wilson, clk.

Rockaway Beach, L. I., N. Y.—A trunk sewer between Rockaway Park and Morton's creek at Edgemore, with a disposal plant on the Arverne Meadows, is proposed.

Muscogee, I. T.—The construction of a sewerage and water works system is contemplated as soon as the treaty between the United States and the Creek nation has been adopted.

Fond du Lac, Wis.—George S. Pierson, C. E., Kalamazoo, has been engaged to make an inspection of the present sewerage system, with a view to making recommendations for improvements.

Newport, Ky.—The water works commissioners recommend in their annual report that the water works department assume charge of the flushing of the sewers and the sewer tapping.

Reading, Pa.—The question of constructing the intercepting trunk sewer in the northeastern sections of the city and for sewers in Frankfort and Eleventh-sts., is being considered.

Jackson, Mich.—The state has appropriated $15,000 for sewers for the state prison, and the city will expend about $35,000 for the construction of sewers in Grand-st., to connect with the state system.

Kansas City, Mo.—Both branches of the city council passed eight ordinances Jan. 16 establishing sewer districts in sewer division No. 3, preparatory to the proposed extension of the O. K. creek sewer.

The question of issuing bonds for the construction of sewerage systems will be voted at the following places: Irwin, Pa., Feb. 19; Mamaroneck, N. Y.; Springfield, N. J.; Pottsville, Pa.; Columbus, Ga., Feb. 6; Shawnee, Okla. T.; Corona, Cal.; Durham, N. C.

Baltimore, Md.—An ordinance has been approved for a sewer on Canton-ave., estimated at $13,500. Dr. James Borley of the health department urges the construction of a general sewerage system as the most urgent necessity confronting this city.

Chicago, Ill.—The estimated cost of the proposed new intercepting sewers, pumping stations and machinery is $1,800,000. The town of Cicero is reported as having applied to the sanitary board for permission to build a sewerage system to be connected with the drainage canal.

Washington, D. C.—The district commissioners have ordered the construction of a sewer on certain streets. The appropriation in the District of Columbia bill for the filtration plant does not specify any particular system of filtration. The tabulated report in the bill indicated that the American system was to be used, but the bill contains no such limitation.

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Plainfield, N. J.—Joseph O. Osgood, C. E., has recommended the septic tank purification system for this city. His plans provide for two concrete septic tanks, 50x100 ft. deep, and 450,000 gals. capacity for 24 hours. From the tanks the septic liquid is to flow over aerating weirs to channels leading to the contact beds, of which there are eight. Of these beds four are at a higher elevation than the others, thus enabling them to give a double contact treatment to the septic fluid.

Traverse City, Mich.—(Special)—Irving Watson, cy. engr., says he has completed plans for sewer district No. 8, covering about 1,400 acres. The council has acted favorably on the committee's report recommending the construction of 1,080 ft. of 34 in., 2,775 ft. 15 in., and 2,080 ft. 9 in. sewer; estimated cost, $7,875. The remodeling and extension of sewers in district No. 4, by laying 2,250 ft. 15 in., and 3,150 ft. 12 in. sewer, is recommended by the committee. Plans for district No. 7 are nearly completed, and part of it will probably be built this year.

CONTRACTS TO BE LET.

Toledo, O.—Sealed bids are asked until Feb. 4 for building a cylindrical pipe sewer in an alley. John E. Annell, cy. clk.

Greenwich, Conn.—Bids are asked until Feb. 11 for building two miles of pipe sewers and 500 feet of tunnel. S. E. Minor, boro. clk.

Litchfield, Minn.—Contract will be sold Feb. 27 for digging and constructing ditch No. 9, in sections of 100 feet. J. N. Gaynor, co. audt.

Alexandria, La.—Sealed bids are asked until Feb. 6 for works connected with improving drainage. J. G. White, pres. bd. state engrs.

Delaware City, Del.—Bids are asked until Feb. 15 for constructing a sewerage system at Fort Du Pont. J. De Lafitte, const. Q. M.

St. Petersburg, Russia—Competitive plans for a sewerage system will be received until Aug. 31, 1901, by a municipal commission. Prizes of $6,480, $4,100 and $2,100 respectively for the best three plans.

Akron, O.—Bids are asked until Feb. 9 for the construction of a main trunk sewer in districts 1, 6, 8 and 9, including lampholes, manholes, ventilators and specials. Chas. H. Isbell, cy. clk.

Cleveland, O.—Sealed bids are asked until Feb. 13 for furnishing material and building two shafts and a tunnel to cross under the old river bed from Sycamore to Elm-sts. Walter P. Rice, dir. pub. wrks.

Findlay, O.—Sealed bids are asked until Feb. 7 for the construction of brick and pipe sewers in sewer district No. 2, with manholes, catchbasins, lampholes, flush tanks, etc. Frank C. Ray, cy. clk.

Atlanta, Ga.—Sealed bids are asked until Feb. 4 for furnishing vitrified sewer pipe, cast iron catchbasins and manhole covers, brick, and for constructing sewers. H. P. Collier, comr. pub. wrks. M. Clayton, cy. engr.

Santiago, Cuba—Sealed bids are asked until Feb. 8 for furnishing cast and wrought iron pipe fittings, lead and yarn, vitrified sewer pipe and tile drain, and vitrified sewer brick. Chambers & Hone, No. 60 New-st., New York City.

Washington, D. C.—Sealed bids are asked until Feb. 16 for furnishing and erecting one compound expansion crank and flywheel condensing pump, together with one vertical tubular boiler and necessary auxiliaries for a sewage pumping plant.

Chicago, Ill.—Sealed bids will be received until Feb. 20 for excavating solid rock from the south fork of the south branch of the Chicago river, near Thirty-fifth-st.; for excavating through the spoil bank of the sanitary district on the north side of the main channel at the east end of sec. K. Alex J. Jones, pres. by trustees of sanitary dist.

Great Falls, Mont.—Sealed bids are asked until Feb. 4 for the construction and extension to Sixth-st., main sewer, including the following: Fifty cu. yds. solid rock exc.; 100 cu. yds. soft rock exc.; 12,200 cu. yds. earth exc.; 2,435 cu. ft. 28-in. pipe; 1,190 ft. 18-in. pipe; 600 ft. 6-in. pipe, 15 manholes; 20 catchbasins. W. H. Smith, cy. clk.

Plainfield, N. J.—Bids are invited until Feb. 18 for improvements to the sewage disposal beds as follows: Seven thousand cu. yds. earth exc.; 14,300 cu. yds. filling; 2,400 cu. yds. concrete; 2 wooden gate houses; 1,565 ft. 4 to 15-in. pipe sewer; 3,720 ft. 3 to 10 in. distributing pipe; 1,950 lbs. cast iron, etc. J. Garrett, cy. engr.

CONTRACTS AWARDED.

Iowa City, Ia.—The contract for a brick sewer on Davenport-st., was awarded, Jan. 10, to Wm. Harrabin, for $1,324.60.

Spokane, Wash.—P. Costello was awarded a contract for a sewer on First-ave., between Ash and Spruce-sts., for $3,284.

Waterford, N. Y.—M. F. Dollard & Co. of Albany secured the contract for the North Side sewer for $14,931.95.

Jersey City, N. J.—The M. T. Connelly Contracting company was awarded the contract, Jan. 8, for a sewer in Henderson-st.

Terre Haute, Ind.—The contract for laying 3,000 ft. of sewer pipe in the Southern Indiana yards was awarded to Voorhees & Grimes.

Huntsville, Ala.—The contract for laying a sewer main from the mill to the Big Spring branch was awarded to Hutchens & Murdock.

Chicago, Ill.—The contract for the completion of the Thirty-ninth-st. intercepting sewer was awarded, Jan. 7, to John P. Agnew.

Bakersfield, Cal.—Sewer contracts have been awarded as follows: No. 1, Lindgren & Hicks, $4,500; No. 2, City Improvement company, $7,000.

Toledo, O.—The contract for the Tredwell-st. sewer was awarded, Jan. 12, to T. J. Kelly for $15,139.40. H. P. Streicher secured the contract for a sewer in the alley between Palmer and Noble-sts. for $6,611.62.

Milwaukee, Wis.—The contract for 1,250 lin. ft. of tunnel of 12 ft. in diameter, in section No. 2 of Kinnickinnic river flushing works tunnel was awarded, Jan. 23, to Meehan & Courtney of Chicago for $41,750.

Bayonne, N. J.—The M. T. Connelly Contracting company of Jersey City secured contracts for two sewers in this city as follows: Avenue F, E. Twenty-first-st. and vicinity, $16,747; Avenue D. between Eighteenth and Twenty-fourth-sts., $7,594.

Paterson, N. J.—Contracts were awarded, Jan. 18, for sewers in five streets as follows: Walnut-st., $523, and Hemlock-st., $386, Peter

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Both & Co.; E. Thirtieth-st., Francis P. Murray, $528; Madison-ave., Philip Kramer. $209; Putnam-st., McLean & Lees, $344.

Allegheny, Pa.—Sewer contracts were awarded, Jan. 7, as follows: Lateral sewer in Brighton road, from present sewer near Harbison's north line to Fremont-ave., $2,234, and from Island-ave. to present sewer near Home-st., $3,669; Samuel Gamble. Main sewer in Marshall-ave., $10,643, and main sewer on Brighton road and Winthorp-st., $7,460, North Side Coal and Land company.

Madison, Wis.—Bids were received, Jan. 11, for constructing two settling tanks and appurtenances, requiring about 580 cu. yds. Portland cement concrete; 800 cu. yds. earth exc.; 700 cu. yds. earth embankment; 27,000 ft. B. M. timber; 400 ft cast iron pipe; 360 ft. vitrified pipe. The bids were as follows: Nicholas Quinn, $8,987; J. W. Mitchell, $8,627; John T. Blake, Dubuque, Ia., $7,020.

Marietta, O.—Bids were received Jan. 15 for building sewers in the third sewer district, as follows: Adams Bros., 4-in. pipe, work and material, 27 cts. a lin. ft; 8-in., 47 cts.; 10-in., 51 cts.; 12-in., 55 cts.; manholes, $27; flush tanks, $35; lampholes, $8; John Wilking, 4-in. pipe, 27 cts.; 8-in., 71 cts.; 10-in. pipe, 74 cts.; 12-in., 85 cts.; 15-in., $1.01; manholes, $25; flush tanks, $35; lampholes, $5. The contract has not yet been awarded.

Boston, Mass.—Bids were received Jan. 12 for constructing and erecting two triple-expansion engines to be connected to pumps for pumping 50,000,000 gals. of sewage per 24 hrs. through head of 45-ft. The bids include economizer, feed water heater, boilers, traveling crane, piping, etc. The bids were as follows: Camden Iron works, Philadelphia, $116,000, with centrifugal pumps; Henry R. Worthington, Brooklyn, $107,000, including centrifugal pumps; $101,000, with vertical fire tube boilers; $223,000, with reciprocating plunger pumps; Holly Manufacturing company, $233,000, with reciprocating plunger pumps; Holly Manufacturing company, $228,000, with horizontal water tube boilers; E. P. Allis company, Milwaukee, $124,000, with centrifugal pumps, and $190,000 with reciprocating plunger pumps; Dickson Manufacturing company, Scranton, Pa., $256,000, with reciprocating plunger pumps, based on 160 lbs. (gauge) initial steam pressure.

WATER-WORKS.

Seneca Falls, N. Y.—Seneca Falls water works plant will be sold at foreclosure sale, Feb. 15.

Boise, Idaho—Municipal ownership of the water works is advocated in the report of Councilman Phelps.

Vineland, N. J.—The water plant has been purchased by this city from Charles Keighley's Sons, for $80,000.

Rensselaer, N. Y.—The residents of this city and Bath will have filtered water by Feb. 1. The installation of the filtration plant has cost $50,000.

Conneaut, O.—The plant of the Conneaut Water Works & Supply company, consisting of machinery, mains, franchises, etc., will be sold by Receiver Frederick O. Howe.

Baraboo, Wis.—The Baraboo water works will be offered for sale June 12, by a United States marshal. The plant is valued at $100,000. This city will bid on the plant.

Dansville, N. Y.—Municipal ownership of the water works and electric light plant is proposed.

San Francisco, Cal.—The question of acquiring municipal water works will be voted on Feb. 1, 1901. Of the two propositions to be submitted, one provides for bringing the water from the Sierras, and the other contemplates the purchase of the plant of the Spring Valley Water company.

Independence, Kas.—In a decision rendered by Judge Skidmore, Jan. 15, the injunction to prevent the city from building a water works plant was dissolved. The bonds were voted last spring, but the injunction secured by the Cherrydale Water company prevented the city from building the plant. Work will begin at once.

Alton, Ill.—A bill was filed in the United States circuit court Jan. 7 by the Farmers' Loan & Trust company of New York, to purchase a mortgage against the Alton Water Works company and the New England Water Works company, given Jan. 1, 1887, to secure $200,000 of 6 per cent. bonds issued on that date and payable Jan. 1, 1907, and for a receiver.

Newly incorporated companies: Florida, N. Y.; Water, Ice & Light Co., Groesbeck, Tex.; Forest Lawn Water Co., Forest Lawn, N. Y.; El Paso Pure Water Co., El Paso, Tex.; Warren Water Co., Warren, Ind.; Euclid-ave. Water Co., Pasadena, Cal.; Artesian Water Co., Santa Paula, Cal.; Buffington Water Co., Buffington twp., Indiana Co., Pa.; Blacklick Water Co., Blacklick twp., Cambria Co., Pa.; Garfield Water Co., Bolivar, Pa.; Penngrove Water Co., Penngrove, N. J.; East Wheatfield Water Co., East Wheatfield twp., Indiana Co., Pa.; Cyclone Water Co., Azusa, Cal.; Imperial Water Co., No. 3, Los Angeles, Cal.

Lincoln, Neb.—Suit was filed in the United States circuit court in this city, Jan. 21, against the city of Beatrice, Neb., to collect the sum of $100,000 bonds issued by that city for the purpose of building and maintaining the city water works system. The petition cites that the city issued bonds to the amount of $115,000 to build and extend the water works system, and that until 1899 interest on the indebtedness was met; that the latter year the city defaulted in its payments and has since refused to make a levy for the purpose of paying the interest.

CONTEMPLATED WORK.

Camden, Me.—A reservoir is proposed.

Grinnell, Ia.—A better water supply is proposed.

Kokomo, Ind.—A municipal water works system is proposed.

Monett, Mo.—Bonds have been issued for improving the water supply.

Yardley, Pa.—Plans will be made soon for a water works system.

Whitman, Mass.—The sinking of test wells for a water supply is proposed.

Asotin, Wash. (special)—It is proposed to put in some new pipe for the water company.

London, O.—The water works company contemplates putting in an air compressing pump.

Lexington, Ky.—The citizens are endeavoring to secure a better water supply.

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Taylorville, Ills.—All consumers will be compelled to place water meters on their hydrants.

Goshen, N. Y.—A bill has passed authorizing this place to improve and extend its works.

Buffalo Lake, Minn.—An engineer will be engaged to make plans for a water works system.

Pawtucket, R. I.—The estimated cost of the proposed pumping plant is $75,000.

Oskosh, Wis. — The Northern hospital needs new pumps and a filtering plant, according to press reports.

Belle Plain, Minn.—Plans and specifications for a water works system will be made by H. H. Woodman.

Loveland, Colo.—The town council has decided to consider the question of an additional water supply.

Sharpsburg, Pa.—The expenditure of $18,000 for certain improvements is recommended by J. Schinneller in his report.

East Grand Forks, Minn.—An ordinance has passed first reading providing for a water works system.

Brookings, S. D.—The question of a water supply for irrigation and domestic purposes is being considered.

Cicero, Ill.—The commissioners appointed to investigate the water and light question advocate municipal ownership.

Auburn, Neb.—A resolution has been adopted offering liberal inducements to private concerns to put in a water and light plant.

Harrisburg, Pa.—An ordinance was passed Jan. 7 appropriating $75,000 for a new pumping engine and to repair the motor house.

Gloucester, Mass.—The board of water commissioners have asked for authority to expend a sum not exceeding $200,000 for improving the water.

Providence, R. I.—A new pumping station is recommended by William H. Barclay, commissioner of public works, in his annual report.

The question of issuing bonds for water works construction has been favorably voted on at the following places: Bonaparte, Ia.; Woodbine, Ia.

Collingwood, O.—A resolution was passed Jan. 25 providing for the issue of bonds for erecting water works by extending the present system. O. Jenkins, mayor.

Oswego, N. Y.—The mayor has been authorized to correspond with expert chemist relative to an analysis of the water taken from the Oswego river.

Muskogee, I. T.—The construction of water works is contemplated to begin immediately after the treaty between the United States and the Creek nation is signed.

Melrose, Mass.—Mayor Larrabee recommends that an appropriation be made each year for cast iron water pipe to replace the forty-five miles of cement pipe in the present system.

Lakewood Hamlet, O.—Special.—Bids are asked for laying 28,000 lin. ft. 6 and 10 in. cast iron pipe in Clifton boulevard. R. G. Wood, hamlet engr.

The question of issuing bonds for water works will be voted on at the following places: Hannibal, Mo.; White Lake, Minn.; Napoleonville, O., Feb. 12; Rutherfordton, N. C.

Philadelphia, Pa.—The department of public works has retained John W. Hill, C. E of Cincinnati, in connection with the improvement, extension and filtration of the water supply of this city.

Sullivan, Ill.—Engineers have been engaged, according to press reports, to make estimates and plans for a new and adequate water supply to be obtained from driven wells and pumping stations.

Bills have been introduced in the legislature for authority to build water works in the following places: Dexter, Me.; Traverse City, Mich.; Attleboro, Mass.; Williamsburg, Mass.; Seaford, Del.; Newcastle, Del.

St. Louis, Mo.—Two bills have been introduced in the municipal assembly, which provide for the expenditure of $225,000, including extensions, improvements and completion of the high-service system and the location of new mains.

Chicago, Ill.—A tunnel 4,300 feet long, to be built under the lake to connect the old two-mile crib with the new Carter H. Harrison crib, is proposed by City Engineer Erickson for the completion of the water system.

Trenton, N. J.—(Special.)—The board of water commissioners have retained Charles Hogue, 39 Cortland-st., New York City, as consulting engineer in the proposed installation of a new 15,000,000 gal. pumping engine. He will prepare plans and specifications.

The construction of water works is contemplated at the following places: Chaska, Minn.; Amherst, Wis.; Radcliffe, Ia.; Wilmington, O.; Aberdeen, Wash.; Cassadaga, N. Y.; Oshawa, Ont.; Syracuse, Ind.; Tullahoma, Tenn.; Elmer, N. J.; Scotch Plains, N. J.; Thomasville, N. C.; Adairsville, Ga.; Peoria Hights, Ill.

New York City—The board of public improvement has authorized the laying of a 20-in. water main in Pelham-ave. and Pelham boulevard, from Third-ave. to Eastern boulevard. The board of estimates and apportionment has authorized the issue of $4,000,000 bonds for increasing and improving the water supply. The sum of $1,800,000 has been voted to be expended in the improvement of Brooklyn's supply as follows:

For lands required for the 48-in. pipe conduit under contract, pumping stations and storage reservoirs, $300,000. For the construction of storage reservoirs on Massapequa and East Meadow creeks, $1,200,000. For improvements to pumping stations, $200,000. For coal houses, pumping machinery, storehouse, etc., at Milburn pumping station, $100,000.

CONTRACTS TO BE LET.

Woodstock, Va.—Sealed bids are asked until Feb. 15 for constructing a water works system. Com.

Monodovi, Wis.—Bids are asked until Feb. 19 for building water works. John D. Pace, chmn. com.

Sleepy Eye, Minn.—Bids are asked until Feb. 6 for a boiler, 50 flues, etc. Peter Geschroninal, vil. rec.

Lancaster, Wis.—Bids are asked until Feb. 14 for drilling for an increased water supply. Ed. M. Lowry, chmn. comm.

Cuyahoga Falls, O.—Bids are asked until Feb. 2 for furnishing 712 tons of cast iron pipe. G. R. James, secy. W. W. trustees.

Ottumwa, Ia.—Sealed bids are asked until

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Feb. 11 for constructing a complete water works. E. Hogland, chmn. water com.

St. Louis, Mo.—Sealed bids are asked until Feb. 8 for furnishing two 36-inch discharge valves. Robt. E. McMath, pres. B. P. I.

Kenosha, Wis.—Sealed bids are asked until April 2 for furnishing and erecting one vertical cross-compound pumping engine of 4,000,000 gallon capacity. R. H. North, supt.

Atlantic City, N. J.—Sealed bids are asked until Feb. 11 for furnishing a pumping engine of 3,000,000 gallons capacity. Louis Kuehnle, chmn. water comrs.

Cleveland, O.—Sealed bids are asked until Feb. 15th for furnishing water gates, cast iron water pipe and special castings and fire hydrants. Walter P. Rice. dir. pub. wrks.

Lake Providence, La.—Sealed bids are asked until Feb. 20 for the construction of a combined water works and electric light plant. G. M. Franklin, mayor.

Cincinnati, O.—Sealed bids are asked until Feb. 13 for tubular and water tube boilers, with mechanical stokers and brick work complete, at Front-st. pumping station. Robt. Allison, pres. B. P. S.

Louisville, Ky.—Bids are asked until Feb. 20 for furnishing the material and constructing a system of American (mechanical) filters for the Louisville Water company. Chas. R. Long, pres.

Brookline, Mass.—Sealed bids are asked until Feb. 19 for building and erecting a vertical triple expansion crank and fly-wheel pumping engine of 5,000,000 gallons, at the Low Service Pumping Station for this city. Water board.

Grand Rapids, Mich.—Sealed proposals will be received until Feb. 15 for furnishing this city with a permanent pure water supply of not less than 10,000,000 gals., bidders to furnish maps, plans and specifications. Jos. Emmer, pres. pro tem., B. P. W.

Pittsburg, Pa.—Separate and sealed bids are asked until Feb. 8 for furnishing and erecting in the Brilliant pumping station two compound condensing high-duty pumping engines, and for the inspection of pumping engines. Geo. H. Nelson, dir. dept. pub. wks.

Troy, N. Y.—Sealed bids are asked until Feb. 8 for furnishing cast iron pipe; constructing a diverting dam and reservoir near village of Quackenkill; furnishing 1,300 brls. Portland cement. John Philan, com. public works.

Philadelphia, Pa.—Bids are asked until Feb. 11 for the improvement, extension and filtration of the water supply, as follows: Contract No. 8, sand ejector; No. 9, cast iron water pipe and special castings, trenching for pipe laying, stop and check valves, stop boxes, frames and covers; No. 10, Lower Roxborough filter plant. Wm. C. Haddock, dir, pub. wrks.

St. Louis, Mo.—Sealed bids are asked until Feb. 8 for laying pump main No. 9, including 18,024 lin. ft. 36, 30, 12, 6-in. pipe, 14 hydrants, 12,000 cu. yds. earth embankment, 170 cu. yds. brick masonry, 84 cu. yds. concrete, 25 cu. yds, rip-rap, 8,700 ft. B. M. lumber. Robt. E. McMath, pres. B. P. I.

CONTRACTS AWARDED.

Woodstock, Va.—The contract for building water works was awarded to G. W. Minor of Davis, W. Va.

Pleasanton, Cal.—The contract for a municipal water works system was awarded to Williams, Baker & Co., for $17,075.

Mena, Ark.—The franchise for a complete water works system was granted Jan. 9 to O. G. Gorman of Dallas, Tex.

Two Rivers, Wis.—F. T. Miller of Chicago was awarded the contract Jan. 18 for a water works and electric light plant.

New Albany, Ind.—The Indiana Water company is endeavoring to secure a franchise to establish a water works system in this city.

Indianapolis, Ind.—A new contract has been made between the city and the Indianapolis Water company by which the city saves $2,000 a month in the new rates, gets more water for public use, and a short time contract.

Pittsburg, Pa.—The contracts for laying the water mains were awarded Jan. 5, as follows: 1st sec. with riveted pipe, F. A. Gillespie company, $92,000; 2nd sec. F. A. Gillespie company, $377,500; 3d sec., Booth & Flinn, $195,000.

BRIDGES.

Newhope, Pa.—A new bridge is proposed to span the mill-dam.

Lincoln, Me.—A petition is being circulated asking for a bridge at Lincoln Centre.

Iowa City, Ia.—The citizens of the north end have petitioned for a new bridge.

Conneaut, O.—A high-level bridge across the Conneaut river is needed.

Newburyport, Mass.—A bridge is contemplated across the Merrimac river by the county commissioners.

Buffalo, N. Y.—The question of building the Grand Island bridge is being revived.

Pittsburg, Pa.—Plans have been completed for an iron bridge to connect Pius and Mission-sts.

Topeka, Kas.—The question of building two new bridges across the Kansas river is being discussed.

Sparta, Tenn.—A bridge across Caney Fork at Sparta and Spencer-road crossing is contemplated.

Nashville, Tenn.—An appropriation of $800 has been voted for a new bridge over Eaton's river.

Gates, Ore.—A petition has been submitted to the county court asking for a bridge across Santrani river at Gates.

South Omaha, Neb.—The question of building a bridge over the Platt river at Cedar Creek is being revived.

Waukesha, Wis.—The city council has decided to build an iron bridge across the Fox river at Forest-st.

Illiopolis, Ill.—The supervisors of Christian county have decided to build a bridge over the Sangamon river.

Miles City, Mont.—Bids are being asked until March 4 for a steel wagon bridge across the Tongue river. Co. clk.

Aberdeen, S. D.—The county board has decided to build a bridge across the Elm, three miles south of Ordway.

East Liverpool, O.—A company has been formed to build a bridge over the Ohio river at the head of Babb's Island.

Michigan City, Ind.—An appropriation for a drawbridge over the harbor, at Second-st. H. M. Wiles, cy. engr.

Fort Plain, N. Y.—Plans are being con-

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sidered for a new iron or steel bridge to replace the one burnt recently.

York, Pa.—Sealed bids are asked until Feb. 26 for all new bridges to be built during 1901. C. C. Boslow, co. clk.

Gray's Point, Mo.—A bill was passed Jan. 22 authorizing the erection of a bridge across the Mississippi river at this place.

Ft. Wayne, Ind.—Plans have been prepared for a bridge over St. Mary's river to replace the present covered wooden structure.

Minneapolis, Minn.—The residents of South Town are making an effort to secure a wagon bridge connecting Cedar-ave. with Eleventh-ave., S. E.

St. Louis, Mo.—The citizens of the city of East St. Louis, Ill., contemplate building a bridge with a 565 foot span across the Mississippi river.

Rowelsburg, W. Va.—An order has been passed by the county court for the construction of an iron bridge across the Cheat river, at this place.

Pine Bluff, Ark.—A bill has been introduced in congress authorizing the construction and maintenance of a steel drawbridge over the Arkansas river.

Canajoharie, N. Y.—The officials of this place and Palatine have perfected plans for a new bridge across the Mohawk river to replace the one burnt Jan. 17.

Columbus, O.—The county commissioners have received a petition asking for a bridge over Rock Fork creek, about two and one-half miles north of Ganamer.

Riverside, Cal.—Sealed bids are asked until Feb. 6 for a bridge across Temecula creek, one and one-half miles southeast of the town of Temecula. W. W. Phelps, co. clk.

French Indo-China—Bids will be received until May 9 for a bridge over the Arroyo Chinais, by the director of public works for Cochin, China, at Saigon.

Chicago, Ill.—City Engineer Erickson has pronounced four bridges dangerous and says that five are so unprotected that the engineering department has refused to accept responsibility for damages.

Cincinnati, O.—The property owners in Rochelle, Stetson, Shillito, Piedmont, Arizona and Goodman-sts., have petitioned for a viaduct for foot passengers and vehicles across the Corrywood ravine.

STREET LIGHTING.

Midland, Md.—A municipal electric light plant is proposed.

Augusta, Ga.—A municipal electric light plant is contemplated.

Utica, N. Y.—This city's electric light contract expires next fall.

Mankato, Minn.—Municipal ownership of the electric light is proposed.

Fremont, Neb.—A new electric light plant is proposed, the old being inadequate.

Gloversville, N. Y.—The electric light plant will be rebuilt in the spring.

Jackson, Tenn.—The city council has decided to build its own electric light plant.

Oshkosh, Wis.—Mayor Mulva advocates municipal ownership of the electric lighting plant.

Fond du Lac, Wis.—A new co-operative electric light plant is to be established in this city.

Stella, Ia.—A company has been formed of local business men to light this town with electricity.

The question of issuing bonds for an electric light plant will be voted on at Farmington, Mich.

York, Pa.—Bids are asked until Feb. 12 for lighting this city. Frank DeHuff, secy. lighting com.

St. Paul, Minn.—The contract for gas and electric street lighting was awarded to the St. Paul Gas Light company.

The question of issuing bonds for an electric light plant has been favorably voted on at Gowanda, N. Y.

Greenville, Mich.—A fifty-year franchise has been granted to N. S. DeMoulin and William Fay, York, Pa.

Mt. Sterling, Ill.—(Special)—A. E. Condee, cy. clk., says this city will construct an electric light plant this year.

Kendallville, Ind.—A committee has been appointed to inquire into the feasibility of a municipal electric light plant.

Steubenville, O.—The question of granting a franchise for an electric light and heating plant will be voted on Feb. 20.

Paducah, Ky.—A municipal electric light plant is proposed owing to the Paducah Electric Light company raising its rates 25 per cent.

Dundee, N. Y.—Bids are asked until Feb. 12 for equipping a plant to be constructed in Pennsylvania. Bailey & Goble.

Baldwins, (L. I.), N. Y.—The establishment of a gas plant to light this and other cities is proposed by New York capitalists.

Collinwood, O.—A resolution has been passed to erect electric light works by enlarging the present plants and system. O. Jenkins, mayor.

Detroit, Mich.—The contract for a complete lighting plant has been awarded to the Northern Electrical Mfg. company of Madison, Wis., for $35,865.

Litchfield, Ill.—The contract for lighting this city was awarded to the Litchfield Light and Power company for 5 years at $72 per lamp per year.

Richmond, Ind.—The contract for a municipal electric light plant was awarded to the Varney Construction company of Indianapolis for $144,490 complete.

Sturgis, Mich.—A council committee has been appointed to confer with the Citizens' Electric Light company for the purpose of purchasing its plant.

Nashville, Tenn.—Plans and specifications for the city's electric light and power plant will be made by Prof. Chas. S. Brown of Vanderbilt university.

Lyons, N. Y.—A five-year contract has been awarded the Lyons Electric Light and Power company for all-night street lighting service every night in the year at $80 per lamp.

Plainfield, N. J.—Councilmen Valliant, Rogert and Lee have been appointed a committee to investigate the advisability of establishing a municipal electric light plant.

Loveland, Colo.—A ten-year franchise was granted L. Kelim, at $7.50 per light per month for 16,000 c. p. incandescent arcs;

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$1.50 per light per month for incandescent lamps of 32 c. p., for street lighting.

Springfield, O.—The contracts for the Springfield Gas Co., and the Springfield Light & Power Co., for street and public lighting at $24 per lamp post and $73 per arc light have been approved.

The construction of electric light plants is contemplated at the following places: Pierce, Neb.; Woodstown, N. J.; Holgate, O.; Magnolia, Ark.; Thayer, Mo.; Lexington, Tex.; Brockton, N. Y.; Tellahoma, Tenn.; Lakota, N. D.; Greenville, Mo.; Lisbon, O.; Mayville, Mich.; Gary, S. D.; Alger, O.; Central City, Neb.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Davenport, Ia.—A crematory is contemplated.

South Bend, Ind.—A garbage crematory is proposed.

Spokane, Wash.—The Dixon crematory has been recommended at a cost of $21,000.

Atlantic City, N. J.—The estimated cost of improving the city crematory is $25,000.

Cathan, Ont.—Information is desired regarding methods of cleaning brick paved streets. J. W. Shackleton, cy, engr.

Detroit, Mich.—The three-year contract for collecting and disposing of the city garbage expires June 30th. Mayor Maybury favors a municipal crematory.

San Francisco, Cal.—A contract for street cleaning has been awarded under the new specifications prepared by the Merchants' Association as follows: District No. 1, the first class streets, 77 cts. per 1,000 sq yds; streets of all other classes, 69 cts.; district No. 2, of all streets, 39¼ cts. a 1,000 sq yds. L. M. King, Supt. Merchants' Association.

TOO LATE FOR CLASSIFICATION

Niles, Mich.—A new bridge will be built across the St. Joseph river at Main-st.

St. Paul, Minn.—Macadam paving is desired by the property owners on W Seventh-st.

Menominee, Mich.—The intake of the water works will be extended into water forty-five feet deep this winter.

Syracuse, N. Y.—Asphalt paving is contemplated for Euclid-ave. from College-place to Westcott-st.

Rock Island—An ordinance was passed Jan. 21 to pave Thirty-eighth-st. from Fifth to Eighteenth-ave.

Custer, S. D.—The business men are endeavoring to secure water works, electric lights and telephone.

Sparta, Wis.—Brick paving is contemplated for the business streets this year. H. Greasdale is interested.

River Forest, Ill.—Bids are being asked according to press reports for lighting the streets. Bd. of trustees.

Buffalo, N. Y.—The legislature will be asked to change the city charter relating to petitions for pavements.

Wichita, Kas.—A petition is being circulated to pave William-st. from the government building to the Santa Fe tracks.

Minden, La.—A franchise has been granted to Felix Drake, Thomas Crichton and R. H. Miller for an electric light plant.

Saginaw, Mich.—The plans for paving Sidney-st., between Washington and Jefferson-aves., will probably be changed from macadam to brick.

Cleveland, O.—The contract with the Cleveland Electric Illuminating company to light this city with electricity was approved Jan. 21.

Ogden, Utah—Notice was filed Jan. 22 giving notice that the city will ask for the appointment of a receiver for the Ogden water system.

Le Roy, N. Y.—The citizens have appointed a committee to advise with the board of water commissioners in regard to obtaining a permanent water supply.

Cambridge, O.—The city council has renewed a contract for electric street lighting for ten years, at $70 per light for 112 lights for all dark hours.

Morgantown, W. Va.—The citizens of S. Morgantown-ave. are petitioning the town council to call an election for the purpose of voting on the question of paving.

Salina, Mich.—The common council has decided to purchase about twenty arc lights for street lighting purposes. The citizens favor the purchase of the plant of the Preston W. Shute Acetylene Gas company.

Bloomington, Ill.—The question of an increased water supply is being considered. A petition will be circulated asking that W. Chestnut-st. from Main to Western-ave. be paved.

New Haven, Conn.—The citizens on Howard-ave., passing through the First, Second and Third wards, a distance of about two miles, are divided on the subject of asphalt and brick paving.

Wapakoneta, O.—(Special)—Samuel Craig, Co. Surv., says a petition is being circulated asking the council to pave Blackhoof-st. with brick or blocks. The work will involve about 10,000 sq. yds.

Albany, N. Y.—The common council voted Jan. 21 in favor of cheaper electric light. The ordinance on which the vote was taken directs the board of contract and supply to let a contract for street lighting at a price not to exceed 28 cents per lamp.

Ann Arbor, Mich.—The city attorney was directed Jan. 21 to draw up an enabling act to go before the legislature, which will permit this city to bond for $30,000 for building a city hall and also to issue bonds for the purchase of the water works.

Syracuse, N. Y.—The board of contract and supply decided Jan. 22 to ask for bids for lighting the streets with electricity. The proposals will provide for the maintenance of 1,200 street arc lights for five years and incandescent lights for the city buildings for the same period. The bids will be advertised ten days.

Creston, Ia.—Mayor Skinner and a special committee are in Omaha, Neb., investigating the Nebraska gas system in that city. This city has been in darkness since the first of the year. When a contention of eleven years' standing between the city and the Creston Gas and Electric company resulted in the severance of all relations between the two, and the lighting service was discontinued. The council will make nothing but a one-year contract with the company, while the company wants a five-year contract.

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Municipal Engineering

VOLUME XX. MARCH, NINETEEN HUNDRED ONE. NUMBER 3.

REPAIRING ASPHALT PAVEMENTS IN CHATTANOOGA.

By Robt. Hooke, City Engineer.

The beauty of a well-laid and properly cared-for asphalt pavement is admitted by all, and it is a justly popular pavement with all who, from observation and experience, have become familiar with its merits; but the objection is not infrequently heard, even from those who otherwise commend this pavement, that asphalt pavements are troublesome to keep repaired, as, it is claimed, only the skilled employes of the asphalt paving companies can make any repairs whatever, and that it is difficult to have the repairs made promptly after the expiration of the guarantees, when repairs become more frequently necessary. This is more especially true in the case of cities of the smaller class where no asphalt plant is maintained, and even where this is done, paving companies find it too inconvenient and expensive to send their working forces at frequent intervals to places where only limited repairs are required, and the result is that, in the case of the older pavements, holes appear from time to time which are left to become more extensive from day to day, until the arrival of the skilled workmen of the paving company, with which an arrangement has been made to execute the required repairs.

The city of Chattanooga has had considerable experience along this line. This city has 2.5 miles of sheet-asphalt pavements, on streets varying in width of roadway from 30 to 70 feet, the present age of which is from nine to twelve years, excepting three blocks on Market street, which were resurfaced last spring by the Barber Asphalt Paving Company. The guarantees on these pavements were, with a single exception, for a period of five years, and the expirations, therefore, occurred from four to seven years ago. After the termination of the guarantee periods, the Warren-Scharf Asphalt Paving Company, which laid the original pavements, visited the city about once a year with its skilled workmen and made all necessary repairs, at a cost to the city of $2, and finally of $1.80, per square yard, for resurfacing alone, the company having maintained a stationary plant here from the time its first pavement was laid in the city, in 1888.

In March of last year the Barber Asphalt Paving Company having resurfaced three blocks on Market street, of the pavement originally laid by the Barber Asphalt Paving Company, in 1888, had, after the completion of the work, about six tons of pavement mixture which had been prepared at its railroad plant, which had been brought here to do the Market street work. This pavement mixture, which was in blocks containing, perhaps, half a cubic foot, was purchased by the city with the intention of using it in making the repairs of the old pavements, which were failing in spots of more or less frequency, it being designed at the time to reheat this pavement mixture, as it was required for use, in a stationary pan, from which it was to have been transported by wagon to the street where the repairs were to be made. This plan, on further consideration, did not impress me favorably, as it would require men at the yard to look after the reheating of the pavement mixture, and three or more men on the street with the fire-wagons and tools, or else a great loss of time if the street force had also to attend to the reheating of the mixture; besides there would be more or less danger of the hot mixture cooling to too low a temperature, if the wagon containing it had to be driven some distance, and the small repairs were scattered over several streets.

It occurred to me that a portable heater for the pavement mixture, in which was combined a fire-wagon for heating the tampers, smoothing irons and asphaltic cement for painting the joints, was more desirable

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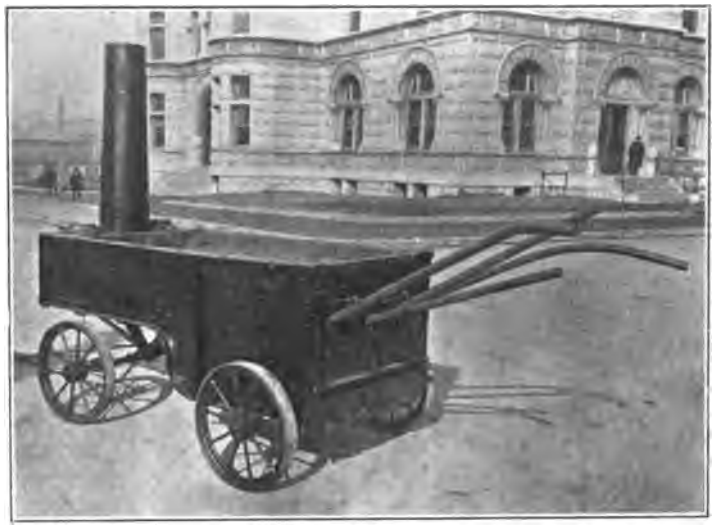
than a stationary reheating pan and a separate fire-wagon on the street, and I accordingly communicated with the most extensive manufacturer of asphalt paving tools, for the purpose of ascertaining whether such a portable heater were manufactured, and, if so, to procure one for use in this city. I was informed that nothing of the kind was manufactured. I therefore designed what I subsequently named a combined fire-wagon and asphaltic mixture heater, and had one built at the boiler works of Walsh & Weidner in this city. This heater has been used from time to time from the first of last November, and to the present time, January 25, 349 square yards of repairs have been made, 71 of which were with the new pavement mixture obtained from the Barber Company, and the remainder, or 278 square yards, were with old material. Of this latter quantity 131 square yards were laid next to an electric railway track which had just been rebuilt, the asphalt pavement having been removed for a foot or more beyond the rails to permit the raising of the cross-ties, and the old asphalt that was taken up for this purpose was reheated and used again. The 218 square yards of ordinary repairs included 271 separate patches in the pavements, giving an average of 0.8 of a square yard to the patch, although some of the individual patches measured as high as eight or ten square yards. No roller was used on any of the work, which was finished with the tamper and smoothing iron alone, the men after a few days' work becoming quite skilled in the use of the tools.

There are probably few, if any, cities having asphalt pavements which do not sooner or later have portions of the asphalt removed in the construction of railroads, conduits or other work requiring the opening of the streets, and by reason of such removals of the pavement a supply of old material may be maintained, and this may be utilized in repairing old asphalt pavements by simply reheating it and adding a small quantity of residuum oil. In this city all of this old material was formerly thrown away, and many tons of it have recently been recovered, and utilized in the manner stated in repairing our older asphalt pavements, with indications, so far, of the most satisfactory results. This old material is of course, not so good as new pavement mixture, but it is not necessary that it should be when used to repair pavements that have been down for a number of years, as it is not important that the material used in such repairs should be superior in durability to the remainder of the old pavement; yet as this material receives an addition of residuum oil it is quite likely, in many instances, to be superior in durability to the average asphalt in the remainder of the street where the repairs are made. Old material in sufficient quantity may not always be on hand, and to meet such an emergency a supply of fresh pavement mixture should be procured from some asphalt paving company.



ASPHALT HEATER AND FIRE WAGON.

The illustration of the combined fire-wagon and asphaltic mixture heater is from a photograph of the one owned by the city

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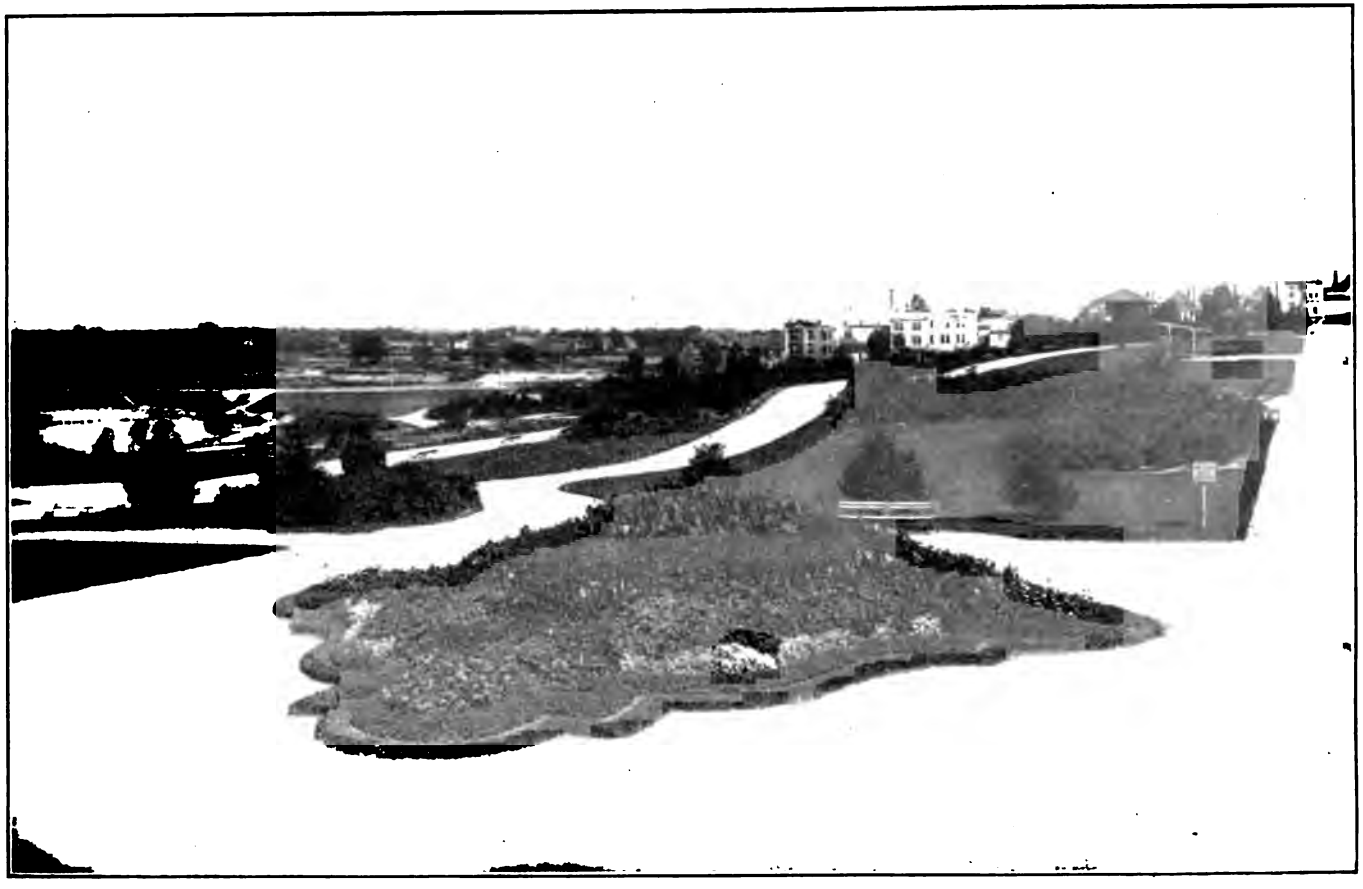

I. BRANCH BROOK PARK, NEWARK. A GARDEN VIEW.

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of Chattanooga, after two months' use in the city, during which time about 300 square yards of asphalt repairs were made. The capacity of this heater is three square yards of two-inch pavement to each batch of material heated. The weight of the heater, with the pan empty, is about 1,900 pounds, but as it is provided with roller bearings, it may be readily drawn by three men up a three per cent. grade, or by one man, on a 0.5 per cent. grade, over an asphalt pavement. The photographic view shows how the machine is used as a tool heater, and at the forward end may also be seen the kettles in which is heated the asphaltic cement for painting joints. The material pan is in the form of a segment of a cylinder, and is made of one-quarter-inch steel plate. The outer shell is of No. 12 steel plate with an interior fire-box lining of cast-iron. The fire-box is provided with cast-iron grate bars, beneath which an ash-pan is provided. Dry wood is the fuel best adapted for the heater. The heater is now worked by a force of three trained laborers, who are regularly employed in the general street force in order that they may be at all times available for asphalt repair work.

If an asphalt pavement is to be repaired, and the area of the surface to be treated does not exceed three square yards, these three men are sent to the yard for the heater, the pan of which, after pouring in a quantity of water, they fill with the pavement mixture, usually old material, start the fire, fill a kettle with asphaltic cement, introduce a smoother and tamper, and then proceed to the street where the repairs are to be made. It requires about one and one-quarter hours to prepare a batch of old material for use, and the tools may be left on top of the heater until time to be introduced into the fire-box for heating. When more than one batch of material is required, a wagon is sent out with the heater, to which the latter is attached, for the purpose of taking a supply of material and fuel to the street. The capacity of the heater is six batches a day, or about 18 square yards when the work is confined to one locality, and the cost of such a day's work in Chattanooga is as follows:

Labor of 3 men at $1.10 per day each.	$3 30
Wagon and team 3 hours.....	75
Total.....	$4 05

If the work is scattered, the wagon and team may be required all day, which would increase the amount by $1.75, or make the day's work cost $5.80. If we add to this the cost of the fuel, residuum oil and asphaltic and hydraulic cement, we shall have a total cost of

For labor and team.....	$5 80
Fuel.....	70
Residuum oil and cement.....	1 00
Total.....	$7 50

This is the cost of the day's work of 18 square yards of resurfacing, not including anything for the old material, which would otherwise be of no value. The cost of labor in the northern cities would be higher than is paid here.

Two sizes will probably be made, one having a capacity of three, and the other of 4½ square yards of two-inch pavement to the batch. Where a considerable quantity of resurfacing is required, two heaters could be employed to advantage, as this would not only expedite the work but would lessen the cost of it per square yard. A patent upon the apparatus has been applied for.

COMPARISON OF COST OF ASPHALT PAVEMENTS.

In December, 1900, Mr. F. V. E. Bardol, chief engineer of the department of public works of Buffalo, New York, sent a circular letter to the cities of the country asking the questions indicated by the headings of the accompanying table, as applied to the year 1900. One caution is included in the following sentences from the letter:

"In some instances the average price for all contracts let might not represent the prevailing rate. If this is the case in your city, I would prefer to have the average of only those streets which were done under normal conditions."

Several cities reported no asphalt laid and several others reported that no asphalt was laid under normal conditions. These are omitted from the table, as well as those the data from which were insufficient to make the reduction to the Buffalo conditions.

Mr. Bardol very kindly furnishes us with the following statement of the bases upon which the corrections to the reported prices are made to reduce them to an equality with the conditions in Buffalo:

"As to concrete, there are a number of apparent discrepancies between the prices submitted per cubic yard and the unit

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COST OF ASPHALT PAVEMENTS INCLUDING BASE, BINDER, WEARING SURFACE.

COMPILED BY F. V. E. BARDOL, BUFFALO, N. Y., JANUARY, 1901.

CITY.	Average price for 1900, including concrete, binder and wearing surface.	Thickness of concrete.	Proportions of concrete.	Cost of concrete per cubic yard.	Correction for concrete, Buffalo specifications.	Kind of cement.	Cost of cement per bbl.	Cost of sand per cu. yd.	Cost of broken stone per cubic yard.	Depth of binder.	Correction for binder, Buffalo specifications.	Thickness of wearing surface.	Correction for wearing surface, Buffalo specifications.	Period of guarantee.	Correction for guarantee, Buffalo specifications.	Hours of labor.	Prevailing rate of wages, common labor.	Correction for labor, Buffalo rates.	Price per sq. yd. reduced to Buffalo specifications. (See foot-note.)	City Engineer.
Altoona	$2 47	6″	1-2-5	$4 20	—.14	Natural	$0 80	$1 55	$1 68	1″	+ .10	1½″	— .19	5 yrs.	+ .15	10	$1 60	+ .04	$2 81	Harvey Linton.
Atlanta	2 83	6″	1-2-4	4 50	—.10	"	1 00	75	1 25	1½″	0.00	1½″	+ .19	10 "	0.00	10	1 00	+ .10	3 02	R. M. Clayton.
Baltimore	2 18	6″	1-3-5	3 30	0.00	"	1 00	75	1 50	1½″	0.00	2″	0.00	5 "	+ .15	8	1 66	0.00	3 33	B. T. Fendall.
Boston	3 25	6″	1-3-7	4 50	—.24	Portland	2 50	1 30	1 70	1½″	0.00	1½″	+ .19	10 "	0.00	9	1 75	0.00	3 20	B. T. Wheeler.
Brooklyn	3 15	5″	1-3-6	5 63	—.17	Portland	2 20	$.75 to $.80	1 60	1″	+ .10	2″	0.00	10 "	0.00	8	1 50	0.00	3 08	Geo. W. Tilson.
BUFFALO, N. Y.	2 20	6″	1-2-5	3 30	.....	Natural	70	$1 25	1 10	1½″	.....	2″	.....	10 "	.....	8	1 50	.....	2 20	F. V. E. Bardol.
Chattanooga	2 68	6″	1-2-5	.....	0.00	"	.....	.....	.....	.....	.....	2½″	— .19	5 "	+ .15	.....	.....	.....	2 64	Robt. Hooke.
Cincinnati	2 05	6″	1-2-6	2 60	—.03	"	60	75	1 35	†½″	+ .10	2″	0.00	5 "	+ .15	10	1 50	+ .05	2 32	H. J. Stanley.
Cleveland	2 17	6″	1-2-4	.....	.00	"	.....	.....	.....	1″	+ .10	2″	0.00	10 "	0.00	.....	.....	.....	2 27	James Ritchie.
Columbus	2 20	6″	1-2-4	3 00	—.11	"	80	1 00	1 10	1″	+ .10	2″	0.00	10 "	0.00	10	1 50	+ .05	2 24	J. Griggs.
Denver	2 13	6″	1-2-4	4 50	—.20	"	1 25	50	2 00	1″	+ .09	2″	0.00	5 "	+ .15	8	1 60	0.00	2 17	W. P. Jones.
Des Moines	1 96	4½″	1-2-4	.....	+ .10	"	.....	40	1 25	1″	+ .10	1½″	+ .19	7 "	+ .09	10	1 75	+ .02	2 46	G. E. Eberhart.
Fort Wayne	2 40	6″	1-2-5	.....	0.00	"	.....	65	1 15	1½″	0.00	2″	0.00	10 "	0.00	10	1 50	+ .05	2 45	F. M. Randall.
Kansas City	2 12	5″	1-2-5	.....	+ .03	"	.....	80	1 00	1½″	0.00	1½″	+ .19	10 "	0.00	8	1 40	+ .03	2 37	R. M. Waddell.
Lafayette, Ind	2 00	6″	1-2-6	4 00	—.11	Portland	.....	.....	.....	1″	+ .10	1½″	+ .19	10 "	0.00	10	1 50	+ .05	2 23	W. K. Eldridge.
Los Angeles	1 80	6″	1-3-6	6 00	—.21	"	2 50	40	1 00	No	+ .28	2″	0.00	No	+ .18	10	2 00	— .01	2 04	F. M. Olmstead.
Milwaukee	1 85	6″	1-2-5	.....	+ .04	Natural	55	65	1 10	1″	+ .10	2″	0.00	5 "	+ .15	10	1 50	+ .05	2 19	C. J. Poetsch.
Montreal	3 25	6″	1-3-4	6 00	—.45	Portland	2 84	75	1 25	½″	+ .19	2½″	— .19	10 "	0.00	10	1 25	+ .07	2 87	John R. Barlow.
New Orleans	2 50	6″	1-3-7	8 00	—.40	"	.....	2 02	2 02	1½″	0.00	2″	0.00	5 "	+ .15	10½	1 50	+ .05	2 80	W. J. Hardee.
Newport News	2 63	6″	1-2-5	4 80	—.25	Natural	95	50	2 20	1½″	0.00	1½″	+ .19	10 "	0.00	10	1 25	+ .08	2 65	T. C. Hatton.
New York	2 55	6″	1-3-6	5.837	—.15	Portland	2 50	45	.....	1″	+ .10	2″	0.00	10 "	0.00	8	2 00	— .07	2 44	Jacob Wund.
Omaha	2 11	6″	1-2-5	5 00	—.03	Natural	$.85 to $.75	$.65 to $.75	$1.35–$1.45	1½″	+ .00	1½–2″	+ .10	5 "	+ .15	10	1 65–1 85	+ .02	2 35	A. Rosewater.
Peoria, Ill.	1 96	6″	1-1½-4	4 50	0.00	"	55	1 00	1 50	1″	+ .10	1½″	+ .19	5 "	+ .15	10	1 50–1 75	+ .02	2 42	H. E. Beasley.
Pittsburg	2 44	6″	1-2-4	.....	— .15	"	70	65	1 70	1″	+ .10	2″	0.00	5 "	+ .15	9–10	1 50–1 60	+ .04	2 58	G. W. Wilson.
Providence, R. I.	2 65	6″	1-2-6	5 10	—.29	Portland	2 20	.50 to .75	2 00	1½″	0.00	1½″	+ .19	5 "	+ .15	10	1 50–1 75	+ .05	2 75	O. F. Clapp.
Rochester, N. Y.	2 11	6″	1-2-4	4 00	—.05	Natural	70	1 00	1 10	1″	+ .10	2″	0.00	10 "	0.00	8	1 50	0.00	2 16	E. A. Fisher.
San Antonio*	1 99	6″	1-2-4	4 40	—.18	"	1 50	1 00	75	No	+ .28	2″	0.00	10 "	0.00	8	1 50	0.00	2 10	E. G. Truhart.
San Francisco*	1 89	6″	1-2½-7	4 86–5 50	—.25	Portland	2.75 to 3.00	70	1.25 to 1.50	No	+ .28	2½″	— .19	No	+ .18	9	2 00	— .03	1 88	E. G. Morser.
Scranton	2 20	6″	1-3-7	4 20	—.17	"	1.80 to 2.00	1 00	1 25	1½″	0.00	1½″	+ .19	10 "	0.00	10	1 50	+ .05	2 27	Jos. T. Phillips.
Spokane	2 29	4″	1-3-6	7 65	—.30	"	4 50	70	.95 to 1.00	1½″	0.00	2″	0.00	10 "	0.00	8	1 60–2 00	— .03	1 96	Otto A. Weile.
St. Paul	2 55	6″	1-2-4	3 00	0.00	Natural	.....	.....	.....	1″	+ .10	2″	0.00	10 "	0.00	10	1 50–1 75	.....	2 65	O. Clausen.
Toledo	1 96	6″	1-2-5	.....	0.00	"	.....	.....	.....	1″	+ .10	2″	0.00	5 "	+ .15	10	1 50	+ .05	2 26	Wm. F. Brown.
Toronto	2 75	6″	1-3-6	5 40–6 00	— .24	Portland	2 24	79	1 60	¾″	+ .14	2½″	— .19	10 "	0.00	9	1 62	0.00	2 46	C. L. Fellowes.
Utica	2 35	5″	1-2-5	4 00	+ .07	Natural	85	.70 to 1.00	1 25	1″	+ .10	2″	0.00	10 "	0.00	8	1 50	0.00	2 52	P. L. Schultze.
Washington, D. C.	1 79	6″	1-2-5	3 50	—.07	"	70	40	1 25	1½″	0.00	1½″	+ .19	5 "	+ .15	8	1 20	+ .05	2 11	C. B. Hunt.
Winnipeg	1 79	4½″	1-3-6	5 74	—.30	Portland	3.65 to 3.80	1 00	1 10	1½″	0.00	1½–2″	+ .09	.....	+ .18	9	1 53–1 80	0.00	1 76	H. N. Ruttan.

The price given in column of price per square yard reduced to Buffalo specifications is obtained by reducing the specifications and prices from the respective cities to Buffalo specifications and prices, assuming that the cost of guarantee for the first 5 years is 3 cents per yard and for the second 5 years is 15 cents per yard. Total, 18 cents per yard.

Average of reported prices is $2.28 per square yard; average of corrected prices is $2.41 per square yard, the price for Buffalo being $2.20 in each case.

*Bituminous rock asphalt. †Cushion.

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prices for the concrete ingredients. In these cases the cost of concrete, exclusive of labor, was figured out from the unit prices. The difference between the price per square yard obtained and the Buffalo price represents the correction.

"The cost of material for binder 1½ inches in depth is taken at 25 cents per square yard. The correction for a different depth is derived by proportion.

"The cost of wearing surface 2 inches in depth, exclusive of labor, is taken at 77 cents per square yard.

"Correction for guaranty is made on the assumption that the cost of guaranty for the first 5 years is 3 cents a yard and for the second 5 years is 15 cents a yard, making a total cost for 10 years of 18 cents.

"Labor in making concrete binder and wearing surface is assumed at 20 cents a square yard in Buffalo."

It will be noted that the average of the reported prices is $2.28 and the average of the corrected prices is $2.41 per square yard, the price for Buffalo being $2.20 in each case.

This attempt to reduce prices to a uniformity of conditions is very interesting and instructive. It is a valuable contribution to the study of asphalt paving. While all may not agree with the author of the table in some of his judgments, the figures are given in sufficient detail to enable each engineer to make the changes which fit his own experience and to continue the investigation on his own lines. Discussion of some of the questions arising will be found in our editorial columns.

BRANCH BROOK PARK, NEWARK, N. J.

We present this month a series of interesting views of the progress of work on Branch Brook Park, Newark, New Jersey, under the direction of the department of parks of Essex county. The park is a long, narrow strip of land of varying width, having a total length of 11,115 feet and an average width of 1,175 feet, being but 685 feet wide at the narrowest part of the main park, and averaging only 268 feet wide in the long, narrow entrance at the southern end. The southern portion of the park site is surrounded by a dense population, and while the adjoining land about the northern portion is now less thickly settled the near future will see the whole park surrounded by an urban district. These facts have decided the question of plan in favor of a detailed and somewhat formal treatment of trees, shrubbery, beds, lawns, drives and walks, giving the park a formal beauty which will aid in inducing the people to preserve its features intact. Work has begun in the southern portion and all our views are taken in the southern division.

Two views show garden views and the formal type of this portion of the plan. These are in older portions of the park and show the areas as they were in the summer of 1899.

Several views show the features of the lake in this division of the park. One gives the mound, with shelter-house for use during showers, located on the east side of the lake: another, a view of the use of the lake for skating, taken on New Year's day, 1900. Two views show the improvement near Clifton and Seventh avenues, one taken in 1896, and the other in 1899, after houses had been removed and park grading and planting had been done. The new high school building, erected at the edge of the park, adds to the value of the improvement. Two views show the method of separating the drive in the park, east of the lake, from the walk, saving a grade-crossing, one view being taken in 1897 of the site of the archway, and the other of the completed arch, in 1899. It will be noted that the side slopes have not yet been put in shape.

All the views show the restricted dimensions of the park and indicate its value to the large population within easy reach of it. The impossibility of isolating the park by treatment of its borders is shown, and the consequent necessity of the plan which has been decided upon. Work is in progress upon the other divisions of the park. It is one of a series of small, medium-sized and large parks and reservations under the control of the commission, the improvement of which will take some years of close application. We are indebted to Mr. Howard J. Cole, engineer-in-chief, for the opportunity to present the graphic report of the progress of the work.

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II. BRANCH BROOK PARK, NEWARK. THE ENGLISH GARDEN.

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HEATING FROM CENTRAL STATIONS—A COMPARISON WITH PRIVATE HEATING PLANTS.*

By Alton D. Adams, M. A. I. E. E.

Heat is a form of energy which each consumer can produce for himself with a minimum of technical skill and investment for equipment. It may therefore be questioned, at the start, whether central heating stations have inherent advantages over the individual plants of consumers, which warrant their existence. The equipment of a central heating plant, to serve a large number of buildings, seems quite likely to cost as much or more, including the distribution system, as would the necessary number of small boilers, furnaces and stoves to heat the several premises.

It is well known that the production of heat on a large scale results in a very material economy of labor per unit, but it is also a fact that much of the labor required in private heating plants represents no addition to the expense for the care of buildings where they are located, beyond that necessary if heat be derived from an outside source. In the larger buildings of a city, however, there is quite sure to be some saving of labor if heat is derived from a public supply.

In the main, it appears that central heating stations can only hope to receive in payment for their service about the cost of fuel that would yield an equal amount of effective heat if consumed in the individual buildings. If this be true, the success of public heating plants must rest in a large measure on their ability either to deliver to consumers a larger part of the total heat of the fuel burned than could be secured from private equipments, or else to utilize fuel that costs less per unit of heating capacity than that used in buildings. There is no doubt as to the advantage of the large heating station over the private plant in the cost of fuel per unit of contained heat. This advantage rests on two causes, the ability of the heating station to buy fuel at cheaper rates, because much larger quantities are purchased than for the private plant, and to burn a lower quality of fuel than that required in most residences and many other buildings. The central heating station by a combination of chimney and mechanical draught is able to burn fine sizes of both anthracite and bituminous coal, that are entirely unsuited for use where only a moderate amount of natural draught is available. Bituminous coals with large per cents. of volatile matter are not suited for use in ordinary stoves and boiler furnaces, and their tendency to produce smoke is also a serious objection to their general application in residences and city buildings. The smoke from a large heating station, being conducted high into the air by a tall chimney, is far less objectionable than it would be if ejected by a large number of low stacks. A result of these conditions is that heating plants of small and medium size in residence and business buildings must often pay two or three times as much for their fuel per unit of heating power, as does the central station.

In addition to its advantage as to the first cost of fuel, the central heating station has another in its ability to supply a greater useful heating effect to consumers from the combustion of a given amount of fuel than they would derive by burning an equal amount of fuel in local heating apparatus. It has been stated that the independent heating plant may deliver as much as 62 per cent. and the combined electric and heating station nearly 50 per cent. of the total heat energy of coal to the premises of consumers, when the loss from distribution pipes does not exceed 20 per cent. of the heat entering them. The higher figure, 62 per cent., corresponds to the total, useful energy derived from the fuel, while the 50 per cent. of the fuel energy delivered in steam or hot water from electric stations is only a part of the products. With coal of 13,000 heat units per pound, the efficiency of 62 per cent. for an independent public heating system corresponds, in heat delivered to consumers per pound of fuel, to an evaporation of 8.3 pounds of water from and at 212 degrees in local boilers for each pound of coal burned. This rate of evaporation is attained in only a small per cent. of the best private heating plants, and it is not uncommon to find an evaporation not more than one-half this rate. A delivery to consumers of one-half of the heat energy in fuel burned at electric stations yields as much heat in buildings as would be derived from the same coal in local plants by an evaporation of 6.73 pounds of water from and at 212 degrees per pound of coal. Even this last result is decidedly above the average for small private heating equipments.

Leaving the saving of labor in private heating plants, by the use of steam or hot

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III. BRANCH BROOK PARK, NEWARK. SHELTER ON MOUND EAST OF LAKE.

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water from a public supply, as an inducement to the change of service, the central station may expect to receive for its heat the cost of the fuel it displaces at the premises of consumers. The stations devoted entirely to the distribution of heat should receive in any case a rate equal to the value of the coal burned in the station boilers at the price that coal of equal heating power costs consumers. The advantage of the station for this last case is determined by the price to it of a heat unit in fuel, compared with the price of a heat unit in fuel to the private plants.

For much of its service the heating station, by reason of its higher efficiency, might obtain the cost to the private plant of twice the weight of coal burned at the station to effect the delivery of a given amount of heat. Combined electric and heating stations, delivering only one half of the total heat of coal to consumers, may usually obtain a sum for service greater than the cost to private plants of the weight of coal burned at the station.

One pound of exhaust steam at atmospheric pressure contains 966 units of latent heat. If an electrical station delivers 30 pounds of exhaust steam, or water to which its latent heat has been imparted, per kilowatt hour to distribution pipes in which a loss of 20 per cent. occurs, consumers receive 23,184 heat units per kilowatt hour of electric output. This amount of heat may be obtained by the combustion of six pounds of coal in a local boiler furnace that evaporates 4 pounds of water from and at 212 degrees per pound of coal. With coal at $5 per ton at private plants, 6 pounds cost 1.5 cents. If the electric station delivers one-half of the total heat of coal to consumers as steam or hot water, only 3.56 pounds must be burned at the station to supply the 23,184 heat units in buildings, and this at $2 per ton costs 0.35 cent, or less than one-quarter of the value of coal to produce equal heating effect when burned in local furnaces. Provided 10 pounds of steam are necessary for each cubic foot of heated space during a season of eight months, the exhaust from an output of 416.6 kilowatt hours is required to heat 1,000 cubic feet. As the exhaust from 1 kilowatt hour displaces coal costing 1.5 cents in the local furnace, the season price to heat 1,000 cubic feet of building space may be 6.25 dollars. From the sale of heat in exhaust steam, electric stations may receive 1.5 cents per kilowatt hour of electrical output, with a steam plant that furnishes only 30 pounds of exhaust steam per kilowatt hour. As the steam consumed by the engines increases per unit of electrical energy, the corresponding heat for distribution and its value grow larger.

It is by no means necessary, however, that an electric station limit its heating business to what can be done with the available exhaust steam. One of the most serious disadvantages, under which electric stations have operated, is the great excess in the capacity of equipment over that necessary for the average load. A result is that much of the steam plant is in operation at such stations during only three or four hours per day, and the item of fixed expenses is necessarily a large one in the charges for electric energy. Fortunately for the combination of electric and heating supply from a single station, the maximum demand for heat is in the former and that for electric energy in the latter half of the day. It is thus possible for an electric central station to do a large business in the supply of hot water or steam directly from the same boilers that are used for the electrical output, in addition to what can be done with exhaust steam. Instead of the 11 per cent. of fuel energy, that central stations devoted exclusively to the production of electric current may distribute, the combined electric and heating plant is able to deliver to consumers more than 55 per cent. of the energy contained in coal, by the supply of electricity and the heat of exhaust.

An addition of heat distribution to the business of electrical stations, thus effects a large reduction in both the fuel item and fixed expense per unit of energy delivered. The income from the sale of heat should warrant a reduction in the charges for electric energy, that would be certain to result in a larger demand. An electric station that distributes 55 to 60 per cent. of the energy in fuel consumed, for either heat, light or power, is obviously in a much stronger position to compete with gas and isolated electric plants than the independent central stations that send out only 11 per cent. of the energy of the coal.

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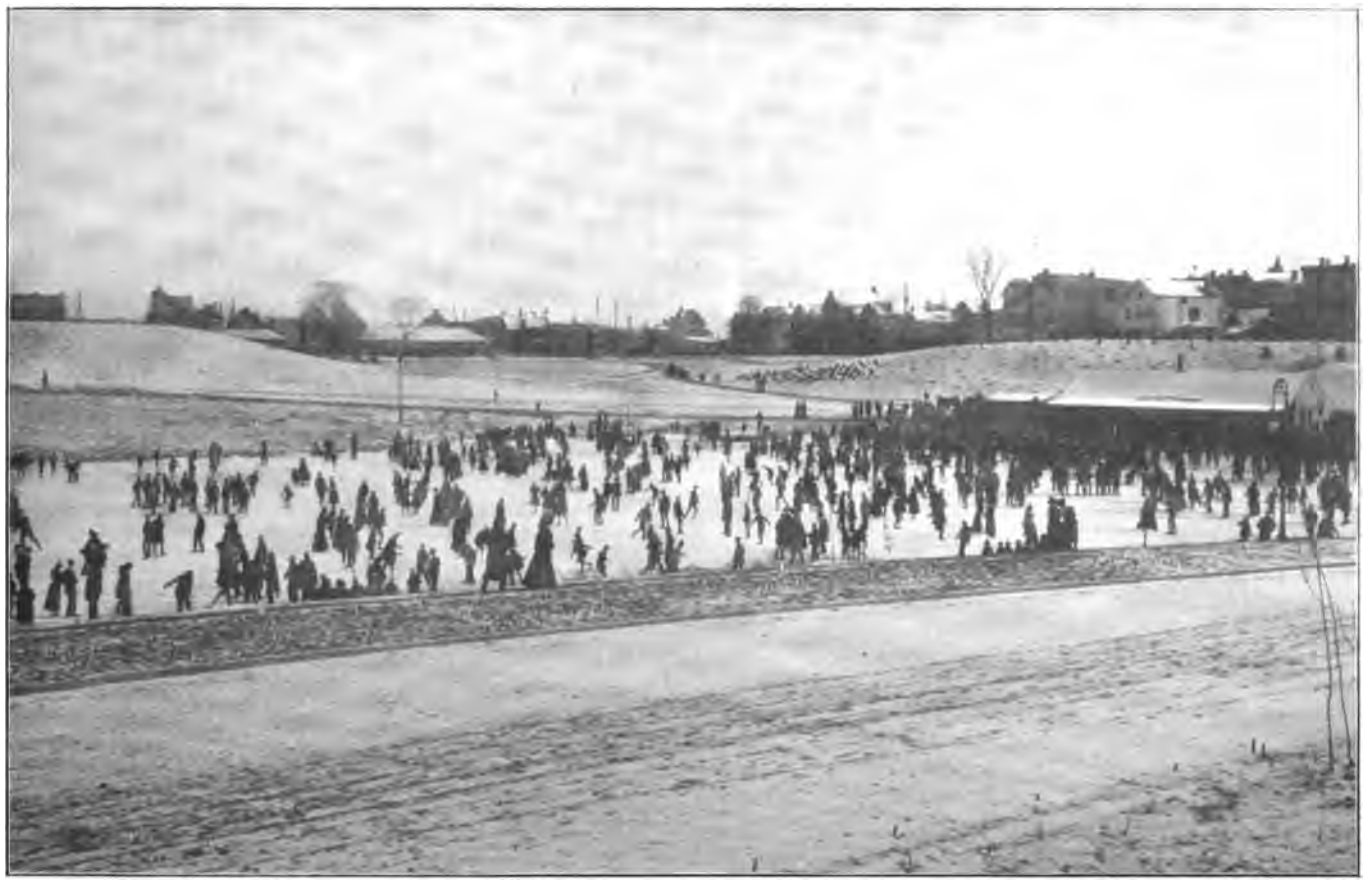

IV. BRANCH BROOK PARK, NEWARK. SKATING ON THE LAKE.

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GARBAGE AS FUEL FOR STEAM PRODUCTION.

By W. L. Hedenberg, New York City.

To find some inexpensive and sanitary method of disposing of the garbage and other refuse which daily accumulates in towns and cities, is a problem that municipal officials have been endeavoring to solve for some time. In many localities the daily accumulation of refuse has been used for filling in low land, while in others situated on the coast it has been barged away at considerable expense to be dumped at sea, only too frequently to be in part brought back by wind and tide to the very shore from which it was taken. The plan of filling in low land with the contents of the garbage pail proved anything but healthful to a community, and, as in the case of Rider's Island near New York City, had to be given up.

An attempt was then made to burn the refuse after removing from it everything having a commercial value, such as tin cans, rags, etc. This was a step in the right direction from a hygienic standpoint, but still left much to be desired in a financial way. In the writer's opinion municipalities in this country have not given the method of garbage disposal now in vogue to a considerable extent in England sufficient attention. Our British cousins have gone a step farther than we have and not only burn the refuse in specially constructed furnaces, but utilize the heat derived from this low grade fuel for generating steam, which may be utilized for heating water for bathing purposes or for operating machinery. It may truthfully be said that a properly designed refuse destructor is at present the only known means of refuse disposal that satisfies both sanitary and economical requirements.

There are a large number of these plants scattered through Great Britain, the most important, however, being those at Shoreditch, Ealing, Oldham, Woolwich, Darwen, Bradford, Norwich and Cambridge. All these destructors are located in the heart of the community in which they are situated, which would certainly make them a public nuisance if disagreeable odors were given off, due to the incomplete combustion of the refuse. No complaints have of late arisen on this score, so it is said, as the gases given off by the burning matter are thoroughly oxidized before being admitted to the open air, by being obliged to pass through the hottest part of the furnace, which is kept at a temperature of 1,500 to 2,000 degrees Fahr.

Probably the most interesting of the various destructor-plants in operation is that at Shoreditch, situated, as it is, in a vestry of London. The station, located in the center of the parish, is well situated, both for the delivery of the refuse and for the distribution of the resulting power. The destructor-house, about 80 feet square, contains twelve destructors, six boilers of the water-tube type and a Halpin thermal storage cylinder, 35 feet long and 8 feet in diameter. The boilers are sandwiched between the destructors, and thus the radiation losses are minimized.

The furnaces or cells, as they are called, are charged from electrically-driven charging trucks, and are estimated to consume from 8 to 12 tons of refuse per cell per day.

The electrical plant driven from these furnaces consists of three 160-kilowatt direct-connected generators at 1,100 volts, and three of 70 kilowatts at 165 volts. There is also a motor-generator of 60 kilowatts capacity which may be used to develop either low or high pressure currents.

The station supplies for public lighting 57 arc lamps until midnight, which are thereafter replaced by incandescent lamps. Several small sub-stations having rotary converters to transform the high-potential alternating transmission current to low-potential direct currents are also supplied. The total number of lamps in operation (16 C. P.) is said to be 5,000. The cost of the installation was about $350,000.

The furnaces have provision for the use of coal instead of refuse, but it is not intended, nor has it been necessary, to resort to this, except on Sundays and other holidays, when there is no collection or delivery of refuse.

Probably the most vital and important portion of these plants is what is known as the Halpin thermal storage system, which consists in heating water to a high temperature under pressure, which permits of the utilization of the energy thus stored in the form of steam at any rate desired. For this purpose large iron cylinders are made use of in which water is superheated when the load on the station is light, to be drawn on during the busy hours.

That this type of garbage disposal plant is the ultimate solution of the problem of refuse disposal for towns and cities there would seem little doubt, as it combines a means of ridding a community of garbage

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V. BRANCH BROOK PARK, NEWARK. FROM CLIFTON AND SEVENTH AVENUES, 1896.

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in the most sanitary manner possible, at the same time with no financial loss; in fact, usually the reverse, as the clinker that remains after combustion makes an excellent substance for mortar or concrete, for which there is a growing demand. It was expected that at Shoreditch, a community numbering a hundred and twenty-five thousand inhabitants, a saving of $30,000 a year would be effected over the previous method of barging the refuse away, and although this hope has not been fully realized, according to the latest figures given out there is a small balance of something like $1,500 on the right side of the ledger.

In the United States, ordinarily, ash-bin refuse will amount to from one to four tons per inhabitant per year, and as such refuse has, according to a recognized authority, a calorific value about one-fifth that of ordinary coal, in a city having an assumed population of 200,000, producing an average of two tons per capita of refuse a year, there would be, theoretically, an equivalent of 80,000 tons of coal, representing an amount of energy equal to 40,000,000 horse-power hours. Of course the above results are merely theoretical and not obtainable in actual practice, but in any case, and allowing there is only a very small profit, as in the case of Shoreditch, the refuse should be burned for sanitary reasons alone, and any profit resulting from the utilization of the heat will be clear gain.

EDITORIAL COMMENT.

Development of Methods of Cement Manufacture.

The enormous development of the cement industry in this country during the last few years is due to two causes. One is the increase in density of population and the consequent increase in the amount of work in which cement has long been used and the great extension of the number of uses to which cement can be put; and the other is the development of labor-saving processes for manufacture which reduce the cost, so that cement can be used for many constructions from which it has been largely excluded on account of the relative cheapness of other materials.

The intermittent vertical kiln, similar to the lime kiln, was first used in burning natural cement, perhaps as early as 1823, in this country. It was soon followed by the continuous kiln, of similar type, but with more than double the capacity, because no time was lost in cooling the calcined material and recharging and refiring the kiln. The comparatively low temperature in these kilns is sufficient for the calcination of the natural cement rock; in fact, a higher temperature injures the product from some deposits of cement rock.

The Portland cement industry developed in other countries, notably in England, France and Germany, using chalk or limestone and clay as materials. Intermittent kilns like the dome kilns, continuous kilns like the Dietzsch, and ring kilns like the Hoffman were used, the high temperatures necessary for complete calcination of the exact mixture necessary for Portland cement being obtainable in the special combustion chambers or by the methods of charging and burning. With the very best of care, however, it was impossible to secure uniform calcination of all the product of the furnace and very careful selection of clinker was necessary that the cement be uniform. This necessitated much hand labor with a certain expertness, and with the vast amount of labor necessary in making bricks, drying them and depositing them in the kiln and the many handlings between, made a total which, under American conditions of labor, insured a price too high to compete with cement produced with the cheaper labor of Europe.

Notwithstanding this and the entire difference in materials, Mr. D. O. Saylor conceived the idea of making Portland cement by European methods, modified to make them fit the materials he had, viz: the natural cement rock of the Lehigh region and limestone. After years of experimenting he succeeded in making a high grade of Portland cement by mixing the two kinds of rock in proper proportions, and by introducing labor saving devices and improved machinery was able to compete in the American market with foreign cements, with some help from the tariff, except where the prejudice in favor of foreign cement, at any price could not be overcome.

Ten years after Mr. Saylor made his first Portland cement Ransome patented in England and the United States the rotary kiln, using gas for fuel, but with the small kilns used and the previous treatment of raw material it was a failure. The Atlas Portland Cement Company took up the kiln, and with the more favorable hard and dry materials of the Lehigh valley finally

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VI. BRANCH BROOK PARK, NEWARK. FROM CLIFTON AND SEVENTH AVENUES, 1899.

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made a success of it. Crude oil was later introduced for fuel and the present tendency is to use finely powdered coal.

With the success of this kiln the development of the Portland cement industry in this country began in earnest. It is possible to carry the material from the raw material cars to the finished package of cement without any handling, and this great reduction in the cost of labor enables the American manufacturer to compete successfully in price with any country in the world.

In 1892 the Warner Portland Cement Company tried the perfected kiln upon wet slurry, obtained by the mixture of marl and clay in pug mills, instead of drying and pulverizing bricks made of it and attempting to calcine this dust according to the method which failed in England. This was successful, and the development of the manufacture of cement in Northern Ohio and Indiana, and in Michigan, is due to this success, the wet material fed in at one end of a 60-foot kiln coming out at the other perfectly calcined Portland cement clinker of the size of peas.

One feature of the rotary kiln process is the absolute uniformity with which the clinker can be calcined. The introduction of variable speed apparatus puts the kilns under the absolute control of the expert in charge of them, and he can determine exactly the rate and amount of calcination the material shall receive.

The capacity of the rotary kilns in use averages about 125 barrels a day, say six times the capacity of the old intermittent kiln. They require more than twice the fuel of the continuous vertical kiln per barrel of product, so that there is some offset to the saving in labor cost.

Another branch of the process in which there has been great improvement is the grinding of clinker and, where required, of the dry raw materials. There are two general classes of mills; those in which the fine dust is separated from the partly ground material, the latter being returned to the mills; and those in which the process is continued long enough to turn out the finished product of sufficient fineness. There are indications of still further improvement in this direction in the near future in regard to cheapness of operation. It is difficult to conceive of a better result so far as fineness and uniformity of grinding is concerned, any desired degree of pulverization being attainable.

The "Directory of American Cement Industries and Hand-book for Cement Users," which is in preparation by Municipal Engineering Company, gives details of the application of these methods in the various cement manufacturing plants in the country.

Requirements For Cement In the report of W. A. Rogers to the Association of Railway Superintendents of Bridges and Buildings upon concrete are two tables of the requirements made by the railroads of the cement to be used on their work. For natural hydraulic cement the specifications vary from 50 to 75 pounds tensile strength neat in one day, the lower figures being the more popular, and but one requiring 75 pounds; from 90 to 130 pounds is required in 7 days; but two give a 28-day test of 150 pounds. For mortar one cement to one sand, one requires 50 pounds in one day and 120 pounds in 7 days; for one cement to three sand, specifications are few, and range from 20 to 27 pounds in one day, 30 to 40 pounds in 7 days, and 56 to 70 pounds in 28 days. For fineness the popular requirement is 90 per cent. through a No. 50 sieve, varying from 88 to 95 per cent., and one requires 75 per cent. through a No. 100 sieve. Six require the cold pat test.

For Portland cement the requirements are quite as varied, in tensile strength running from 100 to 200 pounds neat in 24 hours, from 260 to 400 pounds in 7 days and from 400 to 500 pounds in 28 days. Very few require sand tests, and the maxima are 175 pounds in 28 days for one cement to two sand, and the same for one cement to three sand.

Fineness varies from 85 to 95 per cent. on a No. 100 sieve, with the majority for 90 per cent. Four require the cold pat test and three the boiling test.

Most of the replies to the request for cement specifications were met by the statement that none were required.

But three or four of the roads reporting have what approximate to adequate modern specifications for either natural or Portland cement. Since this is perhaps the most important single material entering into the structures under supervision, such neglect of precaution against receipt of poor material is somewhat surprising. It is doubtful, however, if municipal work will show much better practice, except where the smaller cities model their specifications for public work upon those in neighboring large cities. While few of these cities carry out the tests required in the specifications, their presence as a part of the contract makes it possible to draw the lines tight when necessary without ground for accusation of arbitrary action.

These requirements are presented, then,

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VII. BRANCH BROOK PARK, NEWARK. SITE OF ARCHWAY UNDER DRIVE, 1897.

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not as any indication of what course should be followed, but rather to show what variable results are obtained when specifications are prepared with little study of the material and the requirements that can legitimately be made. So long as dependence was placed on the uniformity of certain brands of cement of established reputation, the lack of rigid specifications, especially for Portland cement, was not so serious, but the vast expansion of cement manufacturing in the United States in the last three or four years and the large number of new brands make the preparation and enforcement of specifications a practical necessity, that the valuable cements may be secured and those which are carelessly or dishonestly prepared may be rejected.

The specifications should fit the work to be done and needless expense should not be added to the work by requiring an expensive cement of high test when a cheaper cement will answer every purpose; but in general it may be said that all the requirements can be materially increased without increasing the cost, the supply of good cement now being so great that the price will become lower until the limit of the saving from modern methods of manufacture is reached.

Comparison of Cost of Asphalt Pavements.

On another page will be found a table giving a comparison of the cost of asphalt pavements in the year 1900 in various cities, the figures being reduced to the conditions at Buffalo, New York, according to the judgment of City Engineer Bardol. His statement of the method of making the reduction, accompanying the table, gives the basis for the comparison.

From the table we present have been omitted such cities as gave insufficient data for determining the price for the last column. The average price actually paid by the cities given in the table is $2.28. Buffalo pays $2.20, or 8 cents less than the average. When the corrections have been made to reduce all to the same condition, that at Buffalo, the average becomes $2.41, and Buffalo pays 21 cents less than the average. That is, Buffalo pays for the same pavement 21 cents less than the average city is paying.

As to concrete, the average city pays about 12 to 15 cents more than Buffalo. This is due to the fact that many of the cities use more natural cement mortar in proportion to the stone, and to the further fact that quite a number use Portland cement. The cost of cement is less in Buffalo, also, than in any other cities, except Peoria, Milwaukee and Cincinnati, which are practically as near their supplies of cement as Buffalo to its supply. Broken stone costs less than the average in Buffalo, but sand costs somewhat more.

Binder and wearing surface both cost Buffalo more than they do other cities, so that the amount saved on concrete is made up on the top layers. This is because the thickness of binder is greater than in the majority of cities reporting, and there are more cities using a wearing surface less than two inches thick than one more than two inches thick.

Guaranty being for ten years in Buffalo and but 5 or 7 years in nearly half of the cities reporting, it is necessary to add 7 or 8 cents to bring the price up to that at Buffalo. Experience in repairing streets in Buffalo doubtless warrants the assumption that it costs but 3 cents to keep a yard of street in repair the first 5 years and 15 cents the second 5 years. If this assumption is correct it will pay all cities, upon the showing of this table, to increase the guaranty period to ten years, for almost all the difference between the average cost and the cost at Buffalo is found in this one item, the others nearly balancing themselves as stated. This means that Buffalo is getting a 10-year guaranty for less money than it would cost the cities to repair their pavements the second five years at the rates in the table.

The labor conditions on the average are not far different from those at Buffalo, what slight difference there is being in favor of Buffalo workmen.

The table and the explanation accompanying it will be valuable to city engineers for comparison with their own conditions, and a careful study of the various items will show in what lines improvements or reductions in cost can be made.

The Buffalo pavements are usually considered to be of the best quality and the wearing surface is certainly stronger than in most cities. This doubtless has its effect upon the maintenance charge, and the figures assumed for such charge may be too small on this account. This would increase the difference in favor of Buffalo. Whether this effect is sufficient to warrant an increase by other cities to the Buffalo specification for wearing surface is questionable. An increase of the guaranty period to ten years without the increase in thickness of surface layer may be more economical in the long run. It would apparently reduce the cost for the first ten years of the life of the pavement.

The names of the contractors laying the

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VIII. BRANCH BROOK PARK, NEWARK. ARCHWAY UNDER DRIVE EAST OF LAKE, 1899.

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pavements are omitted from our table for the reason that the amount and character of the competition does not seem to have any effect upon the average prices for 1900 which can be detected.

Defects in Brick Pavements Under Guaranty.

A correspondent asks what defects in a brick pavement constitute a fair demand for repairs under a guaranty for a fixed period. It is probable that our readers have many varieties of opinion on this subject and some may be willing to express them. Early in the use of brick for paving the tendency was to require but little under the guaranty for a period of years beyond the prompt replacing of bricks found to be softer than their fellows and thus giving rise to depressions the size of the brick but rapidly increasing on account of the added wear upon the exposed edges of the adjoining bricks. As the art of burning paving brick developed, the proportion of such softer brick to pass the selection at the kiln and the inspector on the work decreased. Some makers were so sure of their material that they were willing to give a practical guaranty against wear for a reasonable time, say five years, and to point to the condition of the street at the end of the term as a proof of the indestructible character of their material. The character of the foundation is so essential a part of such a guaranty as this that it has probably been given but seldom, except when the pavement had a properly constructed concrete base, or the traffic on the street was exceedingly light.

For such foundations a guaranty of the whole pavement amounts simply to a guaranty of the wearing surface. But for cheaper foundations, unequal settlement, washing out of filling and even small amounts of subgrade or sand cushion, or the action of heavy loads in forcing sections of pavement down, all have their effect upon the wear of the brick, and the guaranty of the pavement is as much that of the foundation as of the wearing surface.

With so many variations of condition and so many chances for differences of opinion, it is impossible to set a definite rule which shall apply to all pavements. In one place the guaranty means the replacement of soft brick; in another it means practically a guaranty against wear, aside from edges of brick; in another it means a guaranty against settlement of the pavement; in others it means combinations of two or more of these demands; but usually it is an indefinite provision which is difficult to enforce unless the work or material turns out to be so poor that its defective character could have been observed during construction if there had been any inspection worthy of the name.

A few cities have fixed a schedule of repairs that can be demanded for asphalt pavements under guaranty and a similar schedule may be used for the most comprehensive guaranty described above. Settlements of foundation being practically eliminated by its solid character, unless on such a scale as to require reconstruction of the settled portion of the pavement, such guaranty against wear might require replacing of brick when the wear at any one spot brings it say ¼ or ½ inch below the surface surrounding and should certainly cover the prompt replacement of single bricks which are found to be soft enough to show greater wear than those adjoining. Such a guaranty as this can hardly be required of a pavement on a gravel or broken stone foundation, as settlements of such a foundation are apparently inevitable. The limit of variation from a uniform surface must be increased and the necessity of repair and the responsibility for it must be left more largely to the judgment of some expert upon the action of such pavements in use.

If any of our readers have any experience to report, or any suggestions regarding a schedule of repair requirements, we hope to hear from them, and will continue the consideration of the question in the light of such experience.

Should Rates Vary With the Use Made of Water?

The statement is made that the rates for the use of water in Kaslo, B. C., are based, not on the estimated quantity of water used, but on the use made of the water, and it is desired, in preparation for introducing the meter system, to determine the proportion between meter and flat rates for each business listed on the rate card, that the new meter rates may agree as nearly as possible with the present flat rates, when a year's consumption is taken into account.

The usual principle used in fixing flat rates has been to estimate, with very slight approach to accuracy, to be sure, the amount of water to be used legitimately, though the ability of the business to pay for the water used has had some effect, doubtless, in fixing some of the rates. The lack of sufficient data upon which to base such estimates has tended to perpetuate some peculiar rate cards adopted many years ago, but there should now be, in the records of a number of water-works, data which, supplemented by a little effort in de-

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termining the number of barrels of flour used in a bakery, the number of chairs in a barber shop, etc., would give the basis for the comparison desired.

But should the rates be different for different uses of water? It is usually considered that when large quantities of water are consumed there should be a wholesale rate, lower than that for ordinary family use, for example, but from the standpoint of the purveyor of water supply this is not defensible. It costs him quite as much to furnish one gallon of a million to one consumer as it does to furnish one gallon of a thousand to another, and when certain fixed minimum charges, to cover the individual expense of maintaining the connection, reading and recording meter, bookkeeping and collecting are made, he considers that any more water should be paid for at a fixed rate per gallon, no matter what the quantity consumed. If water is pumped, the justice of this is evident. If it is furnished by gravity, in quantities only limited by the capacity of the supply pipe, it is none the less true, though not so important a feature in the rate card.

The development of manufactures is one of the reasons given for the wholesale rate, and if this occurs, and the city as a whole is benefited, the water department or the water company may consider itself justified in its course, though, if meter rates are in force on all connections, it is a question whether the courts would sustain different rates for different customers, were the case properly brought before them. When this argument is carried as far as our correspondent carries it in the question stated in full in our Question Department, the principle involved is more clearly visible, and such discrimination in rates among ordinary commercial consumers as he suggests, is still more doubtful of approval by the legal tribunal.

ANSWERS TO QUESTIONS.

METHODS OF ASSESSMENTS FOR STREET IMPROVEMENTS.

We are about to pave several streets in this borough the coming summer, and will do so on the assessment plan.

The first street to be paved is Morris street, which will include all intersections of alleys and streets to the property line. Some of the cross streets will be paved also.

Would it be proper to assess to the property owners all intersections, or shall I charge them to the borough?

I have made assessments where single street has been paved, taking the total cost of said improvement and dividing this by the total frontage, which gives the pro rata per foot. It hardly looks fair to assess total cost including intersections, when a cross street would not be counted in. It seems to me the borough would have to stand the intersections, especially street. Also, what about the grading, what part goes to the borough, or do you include total cost to property owners?

Would be glad to hear from you, as you receive so much information on these questions.

Geo. D. Jenkins, Board Engineer,
Waynesburg, Pa.

If it were possible to determine exactly the benefit to each piece of property and to the city, the assessment of benefits would be the ideal method. It is quite impossible, however, to do this, and some approximation must be made. Some cities have a provision that not more than 25 per cent. of the value of the property can be assessed against it for any one improvement or in any one year. This is an error quite as often as it is a protection to cheap property. Thus an unimproved lot may prevent the improvement of a street, although the benefit to the lot is such as to make an unsalable lot into good property, while to the adjoining improved lot it gives only a small increase in value.

Frequently the street intersections are assessed against the municipal corporation on the principle that the pavement is a benefit to the city at large and that this is a convenient measure of that benefit. For well traveled thoroughfares this is probably near the truth, but for suburban streets it may often be more than the city's proportion of benefit.

In some cities the entire cost of the pavement, including intersections, is assessed against the property, usually on the principle that the benefits to the property are greater than the amounts assessed, and that the general benefit to the city at large is equalized in the end by the improvement of all the streets with the various grades of material required on the various classes of streets. The inability of the city to pay its share is a prime factor in arriving at this decision in nearly every case. If the scheme of improvements is broad and is proceeded with as rapidly as possible, this argument has much weight, but when a very few streets traveled by all citizens are to be improved, the residence streets being left in their present condition, the argument loses much of its force. There still remains, however, the fact that the assessment of cost is less than the amount of benefits, and the

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claim by some theorists that the remainder should go to the benefit of the city at large. It is not usual, however, to claim more of this balance of benefits than enough to pay the city's share of the cost of the improvement.

The cross streets are benefited by the improvement of a street and should receive a part of the assessment of cost of intersections. In Indianapolis the entire cost of street is assessed on the abutting property and the cross streets for one block each side of the street improved, the cross streets receiving a less rate per front foot than the assessment on the street improved.

It is usual to assess the cost at a uniform rate per front foot as the nearest approximation to an equitable distribution. With a provision for revising the assessment on pieces of property under exceptional conditions, this is the most satisfactory method.

What modifications of these various methods shall be made must be determined by a study of the local conditions, selecting the method and its modifications so that the rule adopted shall make the assessments as nearly proportional to property and general benefits as possible, and shall have few, if any, exceptions.

If grading is heavy enough to be considered separately, it should receive special treatment. Often there must be an assessment of damages as well as of benefits. These may be considered together or separately. Separate boards of viewers for damages and benefits are frequently appointed, the resulting payment to or from the property owner being the difference between the two. Sometimes damages are awarded and the benefits are assessed uniformly per front foot to equal the cost of the improvement as for paving assessments. The argument in favor of including the street intersections in the frontage and assessing their proportion upon the city is stronger than in the case of paving assessments.

MACADAM FOR SMALL CITY.

Mr. H. M., of Connersville, Ind., asks (page 84, February number) for information as to cost, etc., of macadam for small cities. Of course prices and conditions differ in different locations, but the prices here are as follows: Grading, about 20 cents per cubic yard; plank curbing, 3x12, about ten cents per lineal foot, laid; basalt block curbing, (blocks about 10x10x5) about 12 cents per lineal foot; broken stone gutters, stone averaging about four to the square foot, and about 5 inches thick when laid, joints grouted (cement 1, sand 3) cost 7½ cents per square foot; macadam, 8 inches in depth at center and 6 inches at the sides, costs on average 4½ cents per square foot. The cost of the grading and macadamizing includes rolling the roadbed, also the macadam "until no farther settlement can be observed under the city's roller." (A horse roller weighs about 6 tons to a width of 60 inches.)

The population of Petaluma is 3,900. Our business streets are paved with basalt blocks. Residence streets that have been macadamized show but little if any wear in five or six years, notwithstanding they have never been intelligently and systematically cared for. One block that was macadamized two years ago takes all of the heavy hauling from the steamer landing and a good deal from the railroad depot without perceptible wear as yet.

N. S. Frost, City Engineer,
Petaluma, Cal.

ASPHALT BLOCKS.

What have you published in regard to asphalt blocks for street paving? Who manufactures them and the machinery for making them? Are they satisfactory?

Lone Star Asphalt Sidewalk Co.,
Dallas, Texas.

Articles and answers to questions which cover these points will be found in the following numbers of MUNICIPAL ENGINEERING: January, 1898, pp. 34 and 42; April, 1898, p. 210; August, 1898, p. 102; April, 1899, p. 259, and in this number the article on Asphalt Block Pavements in Pontiac, Mich. The makers of the blocks in this country are mentioned in these articles and our advertising columns. The blocks are made by patented process under license of the owners of the patents.

BOOKS ON STREET AND SEWER WORK.

I am an inspector of city improvement work and wish to read some books on the use of cement and on brick paving. Can you give me a list?

A. G. Wooster, Fremont, Wash.

A good hand-book for the inspector is Byrne's "Inspection of the Materials and Workmanship Employed in Construction" ($3). Mr. Byrne has also a good book on "Highway Construction" ($5), which treats of the construction of roads and of city streets with all the materials ordinarily used. On cement a practical book is Spalding's "Hydraulic Cement: its Properties, Testing and Use" ($2). Mr. Spalding also has a small but valuable book on "Roads and Pavements" ($2), covering about the same ground as Byrne, but less exhaustively. Baker's "Masonry Construction" ($5) has

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very valuable chapters on cement and concrete. Johnson's "Materials of Construction" ($6) considers in considerable detail the materials entering into the constructions mentioned, as well as all others in engineering structures. MUNICIPAL ENGINEERING can supply any books desired.

CONCRETE FOR BUILDING FOUNDATIONS.

Can you give us information in regard to the use of concrete for walls, foundations and piers of dwelling-houses? *Roland Park Company, Baltimore, Md.*

The forthcoming "Directory of American Cement Industries and Hand-Book for Cement Users" will contain much upon this subject. For foundations and piers for dwelling-houses, an extra quality of natural hydraulic cement concrete, or one of the cheaper mixtures of Portland cement concrete, will be satisfactory. Box forms must be used where the soil does not confine the concrete. For walls, it is probable that some form of expanded metal construction, as put up by contractors in these materials, will be more satisfactory and cheaper than walls of the thickness necessary if made of concrete alone.

CEMENT FOR STEPS.

We wish to know something of the relative value of stone and cement for use in the steps at the front of a handsome new church we are building. *H. M. Grigsby, Pulaski, Tenn.*

While some kinds of stone are very handsome and durable when used for such a purpose, it is possible to construct steps of cement concrete which shall be as handsome as those of any stone ordinarily used for this purpose, and at a less cost, unless suitable stone is found in the immediate neighborhood. The method of making mixture and of constructing the steps does not differ in principle from that used in making cement walks and curb.

EXAMINATIONS OF CITY ENGINEERS.

Is there a system of examinations of candidates for appointment to positions as city engineer in England, or any eligible list from which such appointments can be made? Does the Institution of Civil Engineers conduct such examinations? *J. R. C., Syracuse, N. Y.*

An editorial on "Certificates of Professional Standing," on page 352 of the number of this magazine for June, 1898, gives some statement of the condition of affairs in England. The Institution of Civil Engineers now conducts examinations for determining the theoretical qualifications of applicants for membership in that body. Membership in the Institution does not, however, carry any more weight in determining the question of eligibility to municipal office than membership in the American Society of Civil Engineers does in the United States. Both societies have some members, admitted years ago, who would not be eligible under the present high standards of qualification set. Membership in either society secured since the adoption of the present standard is evidence of more than average ability as an engineer.

There is in England an Association of Municipal and County Engineers which is trying to create a public sentiment in favor of special qualifications for public engineering service. One of its methods, as explained in the editorial referred to, is by the creation of an eligible list for such appointments. This list is made up from those who pass examinations set by the association. These examinations are open to all applicants whether members of the association or not. The character of the examinations is such that the presence of a man's name on the association's eligible list is evidence of his ability to conduct successfully the operations under the control of the city or borough engineer or surveyor, whatever the name of the office may be. There is no assurance, however, that a municipality will select its officer from this list. The matter is entirely voluntary and is not yet established in public opinion in the position it deserves.

Some municipalities conduct their own examinations of candidates, but even then are not bound to select the most competent, and as a matter of fact often do not.

Practically the question of qualifications of city engineers is in the same condition as in this country, though the eligible list of the association is a ray of light which may increase in brilliancy as its value secures recognition.

VITRIFIED PIPE FOR WATER CONDUIT.

In the matter of vitrified pipe for water conduits in your February number, is it the intention to carry water under a head at any time, and can you give me any data as to what would be a safe pressure upon pipes and joints of a similar nature? *R. W. Farley, City Engineer, Hull, P. Q.*

On page 90 of the article referred to, it will be noted that at one point the Hartford 24-inch pipe conduit was carried below the hydraulic grade line for a distance of 300 feet, being under a head of 9.65 feet at the lowest point of this depression in the line. This would put the pipe under a pressure of about 4 pounds to the square inch. Three lengths of iron pipe were used at the lowest point, not on account of the head, but that

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they might be supported on concrete piers at the stream crossing and thus cheaply prevent settlement. With this exception, it is probably not intended to carry the vitrified pipe under head. There are so many more unknown quantities, in uniformity of material, in strength of joints, in effect of water hammer, and in greater damage from settlements, that a factor of safety for a vitrified pipe is hard to fix; and so, while it is probable that many such lines, as laid, could carry much more than 5 pounds steady pressure, it is seldom that this amount is exceeded.

RELATION OF METER AND FLAT RATES.

Our rates for furnishing water are the ordinary flat rates, and are not based on the amount of water used, but on the use made of the water, so that if meters were introduced, the meter rate per gallon would be different for each business. We wish to introduce meters, to stop the unnecessary waste of water, and would like to make the rates for legitimate use under the meter system as nearly as possible the same as the present flat rates, if we can get any information upon the amount of water, maximum, minimum, or average, used in each business. Included in the list are, bakeries, per barrel of flour; barber-shops, each chair; bath tubs, each tub in hotels, boarding-houses, barber-shops and bathing-houses; blacksmith-shops, each fire; bookbinders, each person; brewers, etc., in the same detail, through the alphabet. Have you any information which will be of assistance to us?

D. P. Kaul, Water Commissioner, Kaslo, B. C.

When the meter system is adopted it is not usual to make the comparisons between the old and the new rates in the form desired, but possibly some of our subscribers have data which they will be willing to put in form. While we may not agree with the statement that the meter rates should be different for different kinds of business, the comparison desired will be of interest, and we will publish anything of value which our correspondents may send in. Some comment on this subject is made by the Editorial Department.

DISCOLORATION OF PLASTERING.

In reply to the inquiry of Chas. Baillairge, C. E., Quebec, for reason of battens or lath showing through ceiling or plastering I submit the following: By reason of the difference in conductivity the spaces between lath are at a lower temperature than the surfaces under the lath, hence the moisture in the air is condensed and smoke and dust absorbed in a larger amount between the lath than under them. From a table of conducting power of different substances I conclude plastering is 32—wood 4. Then if the section through the lath is one-half wood the relative convection of plastering to lath section would be 4 to 1. Hence the space between the lath would be four shades blacker than the surface backed by lath. As a remedy I would suggest a backing of mineral wool or back plastering rich in plaster of paris and wood ashes.

Holland Wheeler, C. E., Lawrence, Kan.

EGG-SHAPED SEWERS.

I would like a book on the design of egg-shaped sewers, and containing tables of their capacity.

J. Ross Robertson, C. E., Keokuk, Iowa.

Folwell's "Sewerage" ($3) gives the principles of the design and construction of egg-shaped sewers and comparisons with circular sewers, all in considerable detail, but does not seem to give tables of flow, although he gives them for circular sewers. Ogden's "Sewer Design" ($2) gives less upon the detail of design and construction but gives a diagram, on a small scale, of discharge and velocity in egg-shapped sewers on various gradients. The best piece of apparatus for the determination of the elements of both circular and egg-shaped sewers is Colby's "Sewer Computer" ($10), being more convenient than most diagrams and absolutely correct, according to Kutter's formula.

CENTRAL STATION STEAM HEATING PLANT.

To the list of central station steam heating plants given in this department in December, 1900, may be added the plant of the Springfield Electric Light and Power Company of Springfield, Ill., A. V. Schroder, superintendent, which uses the Holly or American District Steam Heating Company's system, carries a steam pressure of 4½ to 5 pounds, extends its pipes a half mile from the station, heats about 7,000,000 cubic feet of space, and charges 25 cents a square foot a year for direct radiating surface.

ELECTRIC TRANSMISSION OF POWER IN CEMENT MANUFACTURING PLANTS.

Can you give us the name and location of cement works who have adopted electrical drives for their machinery?

The New England Engineering Co., New York City.

The Whitehall Portland Cement Company, of Cementon, Pa., and the Portland Cement Co. of Utah, of Salt Lake City, have installed full systems of electric transmission of power. Others which use electricity to some extent in the operation of their works, aside from lighting, are the California Portland Cement Company, Colton, Cal.; the Iola Portland Cement Com-

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pany, Iola, Kan.; the William Krause & Sons Cement Company, Martin's Creek, Pa.; the Lawrence Cement Company, of Pennsylvania, at Siegfried, Pa. Some of the works under construction will also use electric transmission, and some of the older works have the system under consideration.

The Alpha Portland Cement Co., of Easton, Pa., will soon install a plant in its works. Consult the forthcoming "Directory of American Cement Industries and Hand-Book for Cement Industries" to be issued soon by Municipal Engineering Company.

STAND PIPES AND ELEVATED RESERVOIRS.*

By George S. Pierson, Mem. Soc. C. E., Kalamazoo, Mich.

It has long been customary to store water at an elevation which will distribute it under pressure for domestic use.

Standpipes and elevated reservoirs on any extended scale are a comparatively late development and are due to improved processes and increased skill in the manufacture and manipulation of iron. Iron is a material particularly well adapted to resist the tensile strains in a tank in which water is confined and is also the cheapest of metals.

Modern progress along this line of construction has made it possible for cities located on comparatively level sites to avail themselves of all the advantages of water pressure due to gravity.

Standpipes and elevated reservoirs are useful in the following ways: They afford much safer fire protection than any means of pumping directly into the water mains. Whatever water may be stored in them may be counted upon with certainty to exercise its maximum possible effort beyond the possibility of interference by the failure of moving mechanical parts, inattention of attendants, etc.

A comparatively insufficient water supply may serve well a much larger city than it possibly could if pumped directly into the water mains.

An important economy in fuel consumption of the pumps is possible where water can be pumped into storage and the pumps during that operation can be run at an economical capacity. In a general way it may be stated that steam pumps when run at one-tenth of their capacity consume about four times the amount of fuel per million gallons as when run at their economical speed. When run at one-fourth their capacity about twice as much, and at one-half their capacity about one and two-thirds times as much.

As a practical illustration, a duplex pump in actual service used an average of 20,000 pounds of coal for each 1,000,000 gallons of water pumped 100 feet high during the year, the average rate of pumping being about one-tenth the capacity of the engine.

If the engine had been run at its economical capacity it should, while running, have used not more than 4,000 pounds of coal in performing the same amount of work, which corresponds to a duty of only 21,000,000. An examination of the performance of gas and gasoline engines under various proportions of load, indicated approximately the relative efficiency.

A 10-horse power Otto engine, under favorable conditions, consumed about the following amounts of gasoline for various loads:

No load (friction of engine).	.11	Gals.	per	hour	per	H. P.
1-6 load	.27	"	"	"	"	"
¼ "	.25	"	"	"	"	"
½ "	.15	"	"	"	"	"
¾ "	.14	"	"	"	"	"
Full "	.12	"	"	"	"	"

From the above table it will be seen that the greatest economy is at full load, and that below ½ load the economy decreases rapidly, more than twice the amount of fuel being required per horse power below ¼ load than at full load.

In steam plants operated in connection with water towers some fuel would be consumed in banking fires, etc. In gasoline plants no fuel would be consumed, except when the pumps were actually in service, and the same would apply to electrically transmitted power paid for by meter measurement. The utility of an elevated reservoir under these conditions is apparent.

In order that the full economy of water towers may be secured in small plants, they should be elevated to a hight which will give fire protection, otherwise the pumping machinery must be always in service, or ready for service, and the full economy in fuel consumption cannot be secured. Low tanks, however, may have an important effect in adding to an insufficient water supply.

It requires more fuel to pump water into a reservoir elevated sufficiently for fire protection than to pump against a lower pressure, but not as much in proportion to the head pumped against, and in any but the larger plants this is more than balanced by the increased economy due to the pumps running at an economical load. In order to arrive at the proper hight of elevated reservoirs a consideration of the requirements of fire and domestic service and of the influence of hose lines, etc., upon the pressure is necessary. Tables are published giv-

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*A paper read before the Michigan Engineering Society.

ing the pressure per square inch required at the hydrant to furnish fire streams of various sizes through hose lines of various lengths. A fair stream such as would be useful in the case of a small detached building, from a ¾-inch nozzle at the end of 100 feet of hose, can be secured with a hydrant pressure of 32 pounds. The same stream, delivered through 300 feet of hose, requires 36 pounds pressure at the hydrant, and through 500 feet of hose, 40 pounds at the hydrant.

It is apparent that a pressure of less than thirty-two pounds at the hydrant, which corresponds to a hight of about seventy-five feet, is of little service as a protection against fire. A pressure of seventy-five or eighty pounds at the hydrant is desirable, and this corresponds to a hight of about 180 feet, not considering the friction in mains. This will supply a one-inch stream discharging 198 gallons per minute through 300 feet of hose, and may be considered a good fire stream. It is desirable to have a pressure, for domestic service, of from thirty to thirty-five pounds at least, and this corresponds to the minimum pressure we have allowed for fire pressure.

The writer does not mean to say that a less pressure than is here mentioned is of no value, but it is extremely desirable to maintain a pressure above the minimum which has been specified.

This brings us to the consideration of the kind of structure best adapted to store water at the desired elevation. If a convenient elevation of ground is close at hand, seventy-five feet or more above the level of the city, the problem is a very simple one, and a plain tank set with its bottom at this elevation will accomplish the desired result. If the city is located upon level ground and no elevation is within reasonable distance the problem is not so simple.

Standpipes have been used quite generally under both of the above conditions. Lately, however, tanks elevated upon trestle towers are often being used under the second condition. The relative advantages and disadvantages of the two types where water must be held in storage at a considerable elevation above the ground level are as follows:

In order to store a sufficient volume within the desired limits of minimum and maximum elevation, it is necessary to proportion the diameter of the tank according to the amount of storage desired If the standpipe form of construction be used this diameter must be continued to the ground. If an elevated tank is used, the structure upholding it may be proportioned simply to meet the strains which come upon it, which are much less than those which come upon a standpipe holding the same amount of water at the same hight, since the effect of wind upon the trestle tower is much less than upon the elevated tank and hydrostatic pressure below the bottom of the tank is exerted on a much smaller area. Much less iron is therefore required in the lower part of the structure than is required in the standpipe below the same elevation.

The relative advantages of the two methods of construction are therefore dependent upon the hight above the ground level at which it is desired to store the water.

The Chicago Bridge and Iron company have kindly sent me some estimates of the cost of structures of both kinds from which I have compiled the following comparative estimates of cost of standpipes and elevated tanks storing certain amounts of water at an elevation of seventy-five feet or more above the ground level.

The comparative cost of standpipe and elevated tank in each case is represented by percentages, and the elevation of the center of gravity of the stored water is also given and it will be noticed that in all cases the elevation of the water stored is greatest in the elevated tank, and that the cost of the tank is less than the cost of the standpipe.

10x100 standpipe, 100 per cent., 87.5 ft. to center of gravity.

15,000-gallon tank, 72.5 per cent., 91 ft. to center of gravity.

12x120 standpipe, 100 per cent., 97 ft. to center of gravity.

40,000-gallon tank, 85 per cent., 108 ft. to center of gravity.

14x140 standpipe, 100 per cent., 107.5 ft. to center of gravity.

75,000-gallon tank, 78 per cent., 124 ft. to center of gravity.

16x150 standpipe, 100 per cent., 112.5 ft to center of gravity.

115,000-gallon tank, 77 per cent., 133 ft. to center of gravity.

18x150 standpipe, 100 per cent., 112.5 ft. to center of gravity.

140,000-gallon tank, 89 per cent., 131 ft. to center of gravity.

20x150 standpipe, 100 per cent., 112.5 ft. to center of gravity.

175,000-gallon tank, 68 per cent., 125 ft. to center of gravity.

The cost of foundations is included.

This indicates clearly the relative cost of the two classes of structure for storing the stated amounts of water at the elevation given. There is, however, another objection to high standpipes. A certain relation of diameter to hight should be maintained in order to secure stability, and this requires the use of such heavy plates in the lower courses as to make this form of construction undesirable, as I shall show later in this article.

In certain locations it may be advisable to support a tank upon a masonry column in preference to an iron trestle tower.

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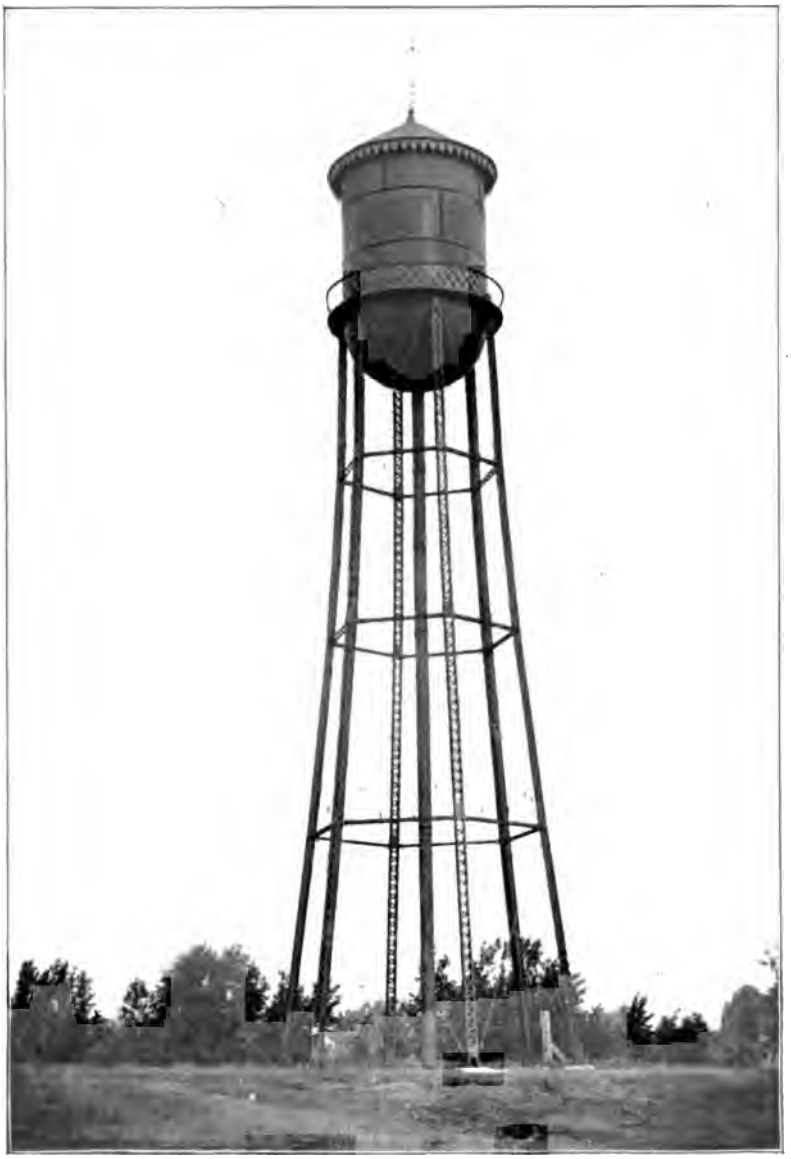
When the tank is to be inclosed the masonry offers a convenient support for the inclosing shell and roof.

Tanks for the storage of waters should be roofed. They should be entirely clear of any inside ladders or similar construction to which ice might adhere.



ELEVATED TANK AT PAW PAW, MICHIGAN.

Probably no kind of engineering structure presents such a lamentable history of failures in comparison with the number of structures built as do standpipes. There have been as many as six failures of standpipes during one year in the United States out of a total number in service of probably less than one thousand.

It may be interesting, especially at a meeting of engineers, to look into the theories upon which these structures have been designed, and to consider the conditions under which some of them have failed and to outline what may be a reasonable provision against the stresses to which they may be subjected.

In the Engineering News of May 24, 1894, is a classified record of the failure of twenty-eight standpipes. Of these, six

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failed while being tested, and in five of these the failure was due to insufficient strength in the side plates. Of the total number of failures, eighteen failures out of the twenty-eight were due to the failure of the side plates; two were due to the collapse of the upper plates during storms from the wind pressure; three were due to insufficient anchorage, and three were due to failures in the foundation. In seventeen cases out of the twenty-eight the failures were total. Three failures occurred during a cyclone or hurricane, three during storms and in eight cases there was ice in the tank.

It will be observed that in many cases failures occurred when the standpipes were subjected to no extraordinary strain and under conditions of service to which they might be subjected every day during the year, and of such it can be said with certainty that they were improperly designed or the construction was faulty. And it is equally certain that many that have not yet failed are subject to the same criticism.

Recent practice seems to favor the use of steel for water tower construction.

The strains which ordinarily come upon a standpipe or elevated tank are those due to the pressure of water within and to the wind.

Extraordinary strains may also come upon a tank. The ones most to be feared are those due to ice. These strains can hardly be computed and may be much greater than any reasonable construction can resist. Ice may form upon the surface of the water in the tank or in the form of a tube around the inside or the tank. It may thus subject the metal to enormous strains. Or, at times when the water is low in the standpipe and warm weather succeeds a period of extreme cold, large masses of ice may become detached from the sides of the tank and fall, creating excessive strains by their impact.

Evidently it is impractical to build structures of iron or steel capable of withstanding the maximum strains to which they might be subjected from this source, and therefore the proper care of such structures when in service is no less important than is their correct design. All that is necessary is to keep the structure reasonably free from ice. This is not a difficult matter in the coldest weather, especially with ground water supplies. All that is necessary in any case is to increase the circulation as may be required for a short period during extreme cold.

If the tank is inclosed, probably no precautions of this kind will be necessary. Inclosed water towers may be made very attractive in appearance and it is in every way desirable to have them inclosed. It adds greatly to the cost, however, and we in the West usually spread a dollar over too many acres. An uninclosed structure may be made quite attractive in appearance at the expense of a little thought. Uninclosed tanks are in successful service nearly as far north as Hudson bay.

The strains which may come upon a tank from its contained water and from wind pressure are readily computed. The strains due to hydrostatic pressure act always in the same way. That is to say, they never alternate in direction. I find a wide difference in the methods by which the strains in the horizontal seams are determined and a corresponding disparity in the strength of seams recommended by various engineers who have proposed formulas for its determination amounting to a variation from lowest to highest of about ten-fold (1,000 per cent.).

The strains upon the horizontal seams of standpipes are due to the weight of metal above the joint and to wind pressure.

The maximum wind strain per lineal inch upon any horizontal joint in a standpipe is equal to the square of the hight above the joint multiplied by the wind pressure per square foot, divided by 37.5 times the diameter.

The value of wind pressure is to be taken at its full value upon a flat surface equal to the diameter of the stand pipe multiplied by the hight above the joint.

In the development of the formula this is reduced one-half, as is customary for cylindrical surfaces.

This, however, gives simply the strain which may come upon the joints during a wind of constant intensity.

The direction of the wind strains alternates as the direction of the wind is reversed; and what is more important to consider, they may alternate rapidly if the wind is gusty and the tank is high in proportion to its diameter so that there is a tendency for it to weave back and forth. Thus excessive strains may be brought to bear upon the horizontal joints and they may fail, as a small boy breaks down a tree by repeatedly pushing it at the proper instant so as to make it weave from side to side. The strains which might come upon the horizontal seams in such a case as this cannot readily be computed, but a reasonable allowance should be made for them. Guys are sometimes recommended for standpipes which are tall in proportion to their diameter. I doubt their utility, however, as it seems difficult to arrange them so as to entirely prevent the weaving of a tall pipe, and if this occurs, the seams must be materially weakened.

Probably the best arrangement of guys would be an arrangement similar to the arrangement of tangent spokes in a modern bicycle wheel in which the guys would be attached to an iron angle surrounding the pipe and would be directly opposed to one

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another and could then be strained to any desired degree without deforming the tank.

Slack guys can have but little effect in preventing the alternation of stresses in the horizontal joints.

In this connection it may be interesting to note that riveted joints slip visibly under a small strain. Experiments have shown in a general way that this may occur at about one-tenth the breaking strain and that hand riveted joints will slip at about half the load required to produce the same effect in machine riveted joints. This indicates that hand riveted joints, particularly, may deteriorate under alternating stress.

The best form of construction seems to be that in which the tank is self-supporting and this favors the elevated tank in preference to the standpipe where water must be stored at any considerable hight above the ground. The strains which come upon a supporting trestle are computed as in bridge work and will not be discussed here.

The most economical form of construction for the elevated tower is that in which the tank has a hanging bottom. This may be accomplished by either a conical bottom or a bottom approaching a spherical form. The latter form occasions less lateral thrust where it is connected with the side plates and requires less strength in the circular girder to offset the thrust. I believe that this form can also be constructed, if properly designed, with less deformation of the plate where it is connected with the side plates than can the conical bottom.

The photograph upon another page shows an elevated tank of this kind which was erected by the Chicago Bridge and Iron company, under the direction of the writer, at Paw Paw, Mich.

The illustration also shows the advantages of design which this kind of structure offers in resisting wind strains. It will be noticed that the base of the trestle can be spread so as to offer more resistance to overturning without materially increasing the amount of metal, the horizontal struts and lateral rods being comparatively light. In this tower the diameter of the trunk is but nineteen feet, and the spread of the base is thirty-six feet.

Water tanks are essentially riveted structures. The number of rivets which enter into the construction of a standpipe is appalling.

A properly proportioned riveted joint, theoretically, is one in which the rivets are equally liable to shear off or to be stripped through the plate, and in which the net section of the plate area has a strength equal to the shearing and bearing value of the rivets. Practically, however, in ordinary construction, and especially in hand riveting in the field, it is wise to depart from the proportions indicated by theory. Theoretical considerations indicate that the diameter of the rivet should be about two and a half times the thickness of the plate. The theoretical maximum possible efficiency of riveted joints is about as follows:

Single riveted .....60 per cent.
Double riveted .....75 per cent.
Triple riveted .....81 per cent.

This efficiency can only be secured, however, by the use of rivets having a diameter about two and a half times the thickness of the plate. In thick plates this would require a diameter of rivet which cannot be well manipulated in hand riveting. It is customary, therefore, to use rivets in thick plates smaller than indicated by the above proportion.

Considering the difficulties of manipulating large rivets by hand the use of comparatively small rivets in thick plates is entirely defensible. It must not be forgotten, however, that the efficiency of the joints, the same number of rows of rivets being used, will be much below the theoretical efficiency above given. For instance, if the diameter of the rivet is equal to the thickness of the plate no greater efficiency can be had than about as follows:

Single-riveted lap joints.....34 per cent.
Double-riveted lap joints .....51 per cent.
Triple-riveted lap joints .....61½ per cent.

Butt joints, double cover straps—

Single-riveted ....51 per cent.
Double-riveted ....68 per cent.
Triple-riveted ....76 per cent.

This important point seems to have been often overlooked, and a misconception of the strength of joints which are made by using small rivets in thick plates seems to have led, in many designs, to a misunderstanding of the factor of safety which was really provided. Further than this it seems to have led to designs requiring more metal than necessary to secure the required strength and which at the same time are too weak for the strains which come upon them. For instance, a tank 40 feet in diameter and 120 feet high, designed with a bottom course of 1 9-32-inch steel plate of 60,000 pounds ultimate strength, joined with three rows of 1⅛-inch rivets, is said to have a factor of safety of 6. No such factor is possible under the circumstances. The strain per lineal inch is about 13,000 pounds, and the ultimate strength of the entire plate (no allowance being made for rivet holes) is but 77,000 pounds, which corresponds with the factor of safety of 6 if the joints had the full strength of the plate. The writer knows of no scheme of riveting which will secure an efficiency at the joints of more than 100 per cent. of the plate. Under the conditions stated, if the joints were lapped joints, no greater efficiency than 63 per cent. could be secured, and the factor of safety would be about 3¾. If triple riveted butt joints with double cover straps had been used, no greater factor of safety could have been secured than about 4½.

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Prof. Pence says: "It is quite generally believed that seven-eighths of an inch or one inch is the maximum thickness of plate which can be satisfactorily riveted by hand in the field, and such a limit should be observed in standpipe designs." Surely if this limit is observed, and a reasonable factor of safety is provided, the standpipe form of construction is not suited to the storage of any great amount of water at any great elevation above the ground. The limits of size which will be set by this thickness of plate and the amount of water which can be stored above any point can readily be determined.

Many careful experiments upon riveted joints have been made, but in many cases erroneous conclusions have been drawn from them. For instance, it has been shown that when holes are punched in narrow strips of steel plate the ultimate strength per square inch of the remaining metal was reduced about 10 per cent. and from this the conclusion has been drawn that the same thing occurs when holes are punched along the edge of a wide plate, as in boiler and standpipe riveting. This result does not necessarily follow. Other experiments on wide steel plates in which a number of holes were punched along the edge, as in standpipe work, have shown that the ultimate strength of the metal between the holes was increased about 20 per cent. for a pitch of 1.9 diameter, 15 per cent. for a pitch of 2 diameters and 10 degrees with a pitch of 3.6 diameters in plates as thick as three-quarters of an inch. It seems entirely reasonable that this should be so in soft steel plate. Undoubtedly in hard steel plates it would not be so. It is conceded that thick plates should be drilled.

Many interesting experiments have also been made as to the effect upon the strength of rivets of various proportions of diameter of rivet to diameter of rivet hole, but a discussion of these would take us too far from our subject.

It may be assumed in a general way that the plate work, which is done at the shop with convenient appliances at hand and under constant supervision, will be more perfectly done than the riveting which is done in the field, in awkward situations, often in inclement weather, with none but the simplest appliances at hand, and not usually under a very rigid inspection.

The writer reasons that the thicker plates are used in the larger structures, that the failure of the larger structures is attended with greater danger than the failure of smaller ones, and that thick plates and large rivets can hardly be worked with the same prospect of securing maximum theoretical strength as can thinner plates and smaller rivets.

There are many important points concerning the design of standpipes and elevated reservoirs that I have not touched upon and that cannot well be considered in a brief article, such as details of construction, anchorage, foundations, corrosion, electrolysis, stiffness in the upper plates to resist collapse from wind pressure, etc., etc.

Perhaps the one of most importance is the last mentioned, since the upper portion of the tanks must be empty most of the time. The record compiled by Prof. Pence shows that in five out of six failures due to wind the upper plates collapsed.

Evidently there is still room for improvement in the design of metal structures for the storage of water.

THE BLOCK ASPHALT PAVEMENTS OF PONTIAC, MICH.*

By William J. Fisher, Engineer, Pontiac, Mich.

A modern pavement that has been in use for a number of years in Washington; New Castle, Pa.; Ft. Wayne and Lafayette, Ind.; Dayton, Hamilton and Youngstown, O.; and for the past year in Pontiac, Muskegon, Grand Rapids and Detroit, Mich., and one that is now being introduced extensively elsewhere is known by the name of asphalt block in contradistinction from sheet asphalt pavements.

In 1899 Saginaw-st. was paved with asphalt block with a total of 26,885 yards, and E. Lawrence-st., 1,335 yards.

In 1900 N. Saginaw-st., 4,267 yards; Clark-st., 2,700 yards; W. Lawrence-st., 2,122 yards; Oakland-ave., 8,003 yards were paved.

The manufacture of asphalt paving block was first taken up in San Francisco in the year 1869 with very crude appliances for making the same.

In the manufacture of asphalt blocks the ingredients are crushed trap rock, limestone or copper ore tailings (the latter material being used in the Lake Erie asphalt block plant at Toledo, O.), and paving cement in the proportions of 85 to 90 per cent. of crushed stone or copper ore tailings and 10 to 15 per cent. of paving cement. The paving cement is made from steam refined Trinidad pitch lake asphalt and heavy petroleum in the proportion of 85 to 90 per cent. of asphalt and 10 to 15 per cent. of heavy petroleum. In the manufacture of asphalt block, if copper ore tailings are the chief ingredient, it is made use of in the same condition as it comes from the mills. If

* From a paper before the Michigan Engineering Society.

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limestone is used it is first crushed, and then rolled and screened until partly pulverized. This material is then heated to a high degree of temperature, mixed with asphaltic paving cement and finally subjected in this heated state to a pressure of approximately 120 tons, equivalent to a 5,000-pound pressure per square inch, molded into a solid, homogeneous block and finally cooled under water. The processes of mixing, heating, compressing and cooling are under perfect control through the medium of modern machinery and appliances and the completed product is ready for immediate shipment.

Asphalt blocks are manufactured in different sizes from 4 in.x12 in. to 5 in.x12 in., and in thickness from 2 to 4 in. The weight of the block is from 12 to 22 lbs.

Gravel 6 in. in depth, compressed with a roller seven (7) tons in weight, and 1½ in. of clean sharp sand spread on top of the gravel, when placed upon a firm sub-grade, furnishes a trustworthy base for an asphalt block pavement.

The following are specifications prepared by the writer and adopted by the common council of the city of Pontiac, Michigan:

The roadway for its entire width is to be graded to such a depth that, when properly shaped and rolled to the satisfaction of the city engineer, it shall be at all points not less than 11½ in. below the surface of the pavement, except that portion occupied by the street car tracks, which shall be 15 in. below. All soft and spongy places not affording a firm foundation will be dug out and refilled with gravel and well rammed. The entire roadbed will be thoroughly rolled with a roller weighing not less than seven (7) tons, to the satisfaction of the engineer.

On top of the sub-grade prepared as above shall be spread a layer of good, clean gravel six (6) inches thick, after being rolled as above specified; one and one-half (1½) inches of clean sharp sand shall then be spread upon the gravel to serve as a cushion for the asphalt block, the surface of which shall conform to the surface of the finished pavement.

The size of the asphalt block will be 4x4x 12 ins., and a variation of one-fourth of an inch from these dimensions will be sufficient grounds for rejecting any block.

The blocks shall be laid at right angles to the line of the street with such crown as the engineer in charge may designate, each course to be laid so that all longitudinal joints shall be broken by a lap of at least four inches.

Each four courses of blocks shall be driven against the preceding course by a heavy maul, in order to make the lateral joints as tight as possible, and the longitudinal joints will be closed by pressing each course in the direction of its length by a lever or jack.

The blocks will then be rammed in a proper manner by a heavy rammer, or rolled with a roller not less than six tons in weight, until they form an evenly curved surface, smooth and unyielding, and finally covered with fine sharp sand, entirely free from loam; the sand to be swept into the joints until the same are filled, and allowed to remain on the streets for thirty (30) days, when it will be removed by the contractors.

Any blocks that disintegrate or wear more than ordinary within five years after the completion of the work will be renewed by the contractor without cost to the city.

The material and workmanship will be guaranteed in an amount equal to 50 per cent. of the total cost five years from and after the date of final estimate of the improvement by the city. The improvement shall be guaranteed to sustain without loss or injury, during the time of such guaranty, the ordinary traffic to which the public streets of the city of Pontiac are subjected.

Among the important features in connection with asphalt block pavement may be mentioned:

1. Its durability and lasting qualities.
2. Ease with which repairs can be made. The repairing outfit in connection with an asphalt block pavement consists simply of a pair of tongs, chisel, hammer and tamper.
3. Asphalt block is not affected by differences of temperature.
4. Asphalt block is sanitary.
5. Asphalt block pavement is smooth without being slippery. When the blocks are first laid there is somewhat of an uneveness on the surface of the pavement, which, however, disappears under the action of traffic.
6. Asphalt block pavement is comparatively noiseless, giving forth but little sound under the rolling of wheels.
7. Asphalt block pavement compares very favorably in cost with other pavements of as high a standard, the material costing approximately $1.90 per yard on board cars at Pontiac.

The finished pavement, including excavation, foundation, curbing, drain tile and all labor, etc., complete, costs $2.40 per sq. yd. This price will vary of course with width of pavement.

No repairs have been made upon our pavements since they have been laid; while their uniformity of appearance; smoothness, without being slippery; cleanliness and high degrees of sanitation, are all elements which contribute to the praise and esteem in which our asphalt block pavements are held.

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EAST HARTFORD SEWER SYSTEM.*

By C. H. Olmstead, Engineer.

The central portion of the town of East Hartford, having grown in population to the point where the necessity of better sanitary condition was apparent to all, decided to build a system of sewers. At first public opinion seemed to be decidedly in favor of the "combined system," probably on account of the extreme flatness of the country and large amount of ground water. After a careful consideration of the recommendations and reports of the engineers the district decided to build what is known as "the separate system" of sanitary sewers.

Plans and estimates were made and adopted and bids advertised for. The contract was let to the lowest bidder; work was started July 10, 1900, and completed Jan. 3, 1901, or in a little less than six months. The system as completed comprises about nine miles of sanitary sewers of salt-glazed terra cotta pipe, including main and lateral sewers, ranging from twenty-four inches to eight inches in diameter, with an outlet about six thousand feet long of thirty-inch terra-cotta pipe; eighty-five manholes and eight flush tanks of the Miller six-inch siphon pattern. The siphons have a tank diameter of four and a half feet, with a discharging depth of thirty-two inches and with a discharging capacity of forty-one cubic feet. Manholes were built at all street intersections, or about five hundred feet apart where the distance was greater between intersecting streets. The comparatively small number of flush tanks is accounted for by the fact that there are a number of short laterals to be constructed in the near future that will be equipped with flush tanks.

The depth of excavation ranged from five feet to eighteen feet and was entirely in sand or clay, no rock being encountered throughout the work. Quicksand was often in evidence, but was not as hard to handle as most strata of sand of this order. Tight-sheeting, the use of clay or sod, and in a few places concrete, combined with patience, were able to secure good work.

Of the nine miles of pipe in the present system, eighteen thousand feet are laid between eight and ten feet below the surface, and 13,700 feet beteen 10 and 12 feet below the surface. The main or outfall sewer is built of terra-cotta pipe 30 inches in diameter; is 6,045 feet long and has a capacity of 4,200,000 gallons daily, sufficient to sewer a population of 55,000 people on a basis of 75 gallons per capita per day. Much water was encountered throughout the district. In many places water was found within 6 feet of the surface of the ground. From 1 to 3 diaphragm pumps, manned by from 2 to 4 men each, were in use with every gang of men, and although no steam pump was used at any time on the work there were places where a steam pump would have been of decided advantage. On account of the large amount of ground water and running sand, tight joints were difficult to make, but by the use of a hemp gasket, cement and protecting the cement by clay or sod, fairly tight work was secured as is shown by the comparatively small amount of leakage. This leakage of ground water amounts to 1¾ inches in depth at the terminal of the outlet sewer. In the laying of pipe, cement was placed on the bell, hemp gasket soaked in cement water placed on top of the cement, the ends of the gasket lying at the sides of the trench, a pipe inserted on the top of the gasket, a blow of the foot on the pipe to bring it into place, ends of the gasket brought over the top of the pipe and twisted, joint thoroughly filled with cement, and clay or sod used to cover the cement and hold it in place until it has time to set.

In laying the 30-inch pipe, a ditch derrick with a winch was used. These pipes are 2½ feet long, 2¼ inches in thickness; depth of socket 3½ inches, and weight about 675 pounds per foot. Joints were made much the same as with small pipe except that the joints from the inside of the pipe were filled with neat cement. All manholes are either 4 feet circular or 3x5 elliptical, and have 8 inch walls and are plastered outside from top to bottom with cement and painted inside with cement wash. Whenever possible, channel pipe was used for inverts.

American Portland cement in a mixture of one part by measure of cement to two parts of sand was used on all brick and stone masonry and in the laying of all sizes of pipe, except the thirty-inch.

The contract price will amount to about $59,500. Extra work or work not provided for in the contract amounts to about $500.

This system as outlined, empties into the Hockanum river a little less than a quarter of a mile from the point where the Hockanum meets the Connecticut river.

Realizing that the time is not far distant when this state, and I trust all states, will take some legislative action prohibiting the pollution of our streams and rivers by emptying into them the garbage and sewage from cities and towns, this sewerage system was so planned that we could for the present help to increase the nuisance that already exists by the pollution of our streams. When the time comes, as it must come, when all cities and towns shall be placed on the same footing in regard to this matter of the pollution of streams, then we will

* From a paper before the Connecticut Engineering Society.

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probably be in a financial condition to erect a pumping plant and construct filter beds. The natural advantages for such a plant within 500 feet of where the sewer now enters the river are very great.

No especially difficult engineering problems were met in carrying on the work. The sore point, or the work on which most stress was laid and the inspectors instructed to be most particular about, was tight joints, a very necessary characteristic of the separate system of sewers.

CURRENT INFORMATION.

Imminent Gas War in Hamilton, Ohio.

Mr. John Lorenz, superintendent of the municipal gas plant at Hamilton, O., makes the following statement regarding the gas situation in that city to a representative of Municipal Engineering:

The city of Hamilton is again in the courts in legal contest with a private corporation, the Hamilton Gas Light and Coke company, on account of the city's ownership of its own gas works.

In order that this struggle between private and municipal ownership, at present, may be well understood, a brief recital of conditions leading up to the building of the municipal gas works will be of assistance.

Until 1855 Hamilton was lighted by primitive methods. Then came the organizers of the Hamilton Gas Light and Coke company, who secured a franchise, without limit as to time, and the city of Hamilton, to help the organization, subscribed for its stock to the amount of $5,000. Everything went well until 1887, when the gas company and the city authorities began to clash on account of the failure of the company to extend mains into the new additions of the rapidly growing city. A demand for a reduction in the price of gas was likewise made by the city and refused by the company.

After going to much trouble to prove that they could not make and sell gas in Hamilton for $1.50 per thousand, as demanded by the council, they came forward with an offer to supply the city lamp posts and buildings at $1.50 per thousand. The people by a large majority decided at an election to build their own gas works. At the time this action was taken by the citizens of Hamilton they were paying to the gas company one-fourth of all the money raised by taxation to defray the expenses of the city. Special legislation was not required to enable the city to build its own gas works.

After the legal battles and preliminaries, during which the gas company had fought the city from court to court, the city was found to be clearly in possession of the right to proceed.

Finally in 1890 the city gas works were completed, and on the 30th day of April of that year gas was supplied for the first time from them. The price of gas was at once placed at $1 per thousand. The price of gas has gradually been reduced until at present it is 80 cents per thousand cubic feet, and the gas company has kept on in the business, notwithstanding its former protestations that it could not sell gas at a profit at $1.50 per thousand. In 1898 the writer became superintendent of the city gas works, and in the annual report for that year and also in that for 1899, after going over the situation carefully, made a recommendation that the city purchase the gas company's works.

The gas company then came to the city with an offer to make a lease or operating contract under which it was to operate the city gas works as well as its own. This application was not given consideration

The gas company thereafter devised a plan to introduce the Otto coke process and perfected arrangements to build a fifty-oven plant just north of the city.

The coke company, being a separate organization, laid its pipe line along the right of way of the C., H. & D. R. R. Co. to the city limits, and the gas company, starting at the city limits, laid the main down to a point within 3,000 feet of its works.

Upon discovering the intention of the gas company to connect its works with the Otto coke company's pipe line the city threatened to arrest its men if they did not cease to dig up the streets. The gas company enjoined the city from executing its threat and the city asked for injunction to stop the work. Both injunctions were allowed.

The city at once passed an ordinance to make it necessary for anyone desiring to open the streets for any purpose to secure permission first from the board of control.

The case of the city vs. the gas company to enjoin the work of laying the pipe was heard and dismissed, the court holding that the company had the right to lay the pipe. The gas company at once started laying the mains without regard to the ordinance. The board of control through the mayor had the workmen arrested, and the gas company promptly had the board of control and the mayor cited for contempt of court, claiming a violation of the injunction to prevent interference. The case was heard, and the judge fined the members of the board of control, the mayor and the chief of police each $10 and the costs. The gas company now promises to bring in Otto gas and reduce the cost.

Electric Lights for Small Cities.

Electric street lighting in small cities was the subject of a paper read before the Iowa Engineering Society by Prof. G. W. Bissell of Ames, Ia., who expressed himself as doubtful that the small city had followed the best plan for lighting the streets. He said that in his part of the country, at least, lighting was obtained from arc lamps hung at street intersections, or by incandescent lights of 16 to 32-c. p., distributed in the same way, or by a combination of the two systems, arc lights being used in the thickly built and the incandescent lamps

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in the outlying districts. He cites that the average arc lamp costs about $15, which would buy 75 16-c. p. or 50 32-c. p. incandescent lamps, neglecting cost of installation. The power of one arc lamp would furnish power for 10 16-c. p. or 6 32-c. p. incandescent lamps, and no trimming or cleaning is required. On the other hand, the mean spherical candle-power of a 1,200-c. p. arc lamp is 400, while incandescent lamps run with the same power would furnish not more than half that amount. He believes that, all things considered, 16-c. p. incandescent lamps distributed at regular short intervals on both sides of the street would give better distribution of illumination than the system now most generally used. In blocks of 400 to 500 feet there should be four 16-c. p. lamps, two on each side, alternating along the block with those on the other side. The lamps should be carried on neat iron posts with brackets so as to carry the lamp about twelve feet above the sidewalk. They should be installed on the series system with shunt boxes. The wiring should be lead-covered cable laid underground in galvanized iron pipe, sewer tile or wooden troughs, about two feet below the surface. Prof. Bissel said this system would cost more than the present generally used system, but the result would be more satisfactory as far as illumination is concerned, and these would be in addition to the advantage of dispensing with overhead wire and unsightly supporting poles.

Electric Wires Must Go Underground in Baltimore.

The electrical commission of Baltimore, Md., served notice on the electric companies Feb. 13, to place all overhead electric wires, except trolley wires, under ground in the city's conduits before the end of the present year. In accordance with the law, 150 days will be given the companies in which to complete the work, and, that they may have all the time needed, these 150 days will be reckoned from March 31, thus making the date of expiration Aug. 28. If at the end of this time all poles are not down the electrical commission is authorized to "chop or saw them down, or remove them," which Mayor Hayes says will be done.

Oakland Water Companies' Consolidation Is Legal.

A decision rendered by Judge Hart, Jan. 22, prevents the city of Oakland, Cal., from making any inquiries about the consolidation of the Contra Costa water company and the Oakland water company, or about the water rates that existed prior to the consolidation. The attorney for the city attempted to show that the companies consolidated for the purpose of raising the rates, and that such action was contrary to law. He claimed the right to produce evidence about the former rates on the ground that the evidence would have a bearing upon the price said to have been paid by the Contra Costa company for the Oakland company's property, and that it would tend to show that the Contra Costa company was able to supply the city with water without drawing on the Dingee wells. The attorneys for the Contra Costa company relied upon a supreme court decision that water companies may combine and that the combinations are not illegal, for the reason that the city has the right to fix the water rates. The attorneys also held that the matter of competition had nothing to do with property values or with the question whether both plants were needed in supplying water to the city.

In ruling against the city, Judge Hart stated that he had no doubt in his own mind that the two water companies combined for the purpose of doing away with competition, but the motives for the consolidation had nothing to do with the case before him. Even though the consolidation was effected by fraud or for fraudulent purposes, the only question before him was whether the rates now charged were reasonable and proper. The testimony about the consolidation and the subsequent increase in rates was, therefore, declared to be inadmissible.

Issue of Bonds for Municipal Water Works in Denver Illegal.

A decision rendered by Judge Riner of the United States district court Feb. 11, declares the bonds voted for two years ago for municipal water works at Denver, Colo., are illegal. The judge held that the proposed bond issue is illegal because it was voted at a special election; because the people voted on two contrary propositions to buy or to build; because the city made a 20-year contract for water with the Denver Union Water company in 1890, which does not expire for nine years. The judge, while holding that the city itself cannot build works, does not say it may not allow a second company to do so.

Water Meters Recommended for Buffalo by Superintendent Illig.

The report of Frank J. Illig, superintendent of the bureau of water, Buffalo, N. Y., on the subject of water pumpage rates and meters in that city, shows a total during 1900 of 39,920,777,100 gallons of water pumped, equal to a daily average of 109,371,992 gallons, or a per capita consumption of 273 gallons, based on a population of 400,000 inhabitants. Since 1895 a marked increase in pumpage has occurred, the pumpage for that year being 34,000,000,000 gallons against 39,000,000,000 gallons for 1900, an increase of 5,000,000,000 gallons.

The report states that Buffalo leads the United States in per capita consumption, and says: "This would be commendable

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were the water actually used; but we are aware that great quantities (at least two-thirds of pumpage) are wasted. The remedy for this is closer and more frequent inspection and the gradual introduction of the meter system." The report shows that, on account of the great waste, the revenue from water pumped shows Buffalo at the foot. Cleveland, Chicago and Detroit earn $35.34, $35.21 and $29.22, respectively, per million gallons, while Buffalo earns only $18.97, less than 2 cents per 1,000 gallons, on present basis of rates. Were this great leakage stopped, estimated at two-thirds of all the water pumped, the rate could be reduced 25 per cent. to the individual householder.

The importance of reducing the water rates is pointed out by Superintendent Illig, who holds that a decrease in water and an honest decrease in price to consumers will be obtained by the judicious installation of more meters. He points out that the use of meters in Detroit, introduced in 1886, has enabled that city to hold its pumpage at a stationary figure for ten years, although the population has increased 75,000. This indicates a fixed consumption for ten years with a 56 per cent. increase in population and a per capita decrease from 203 to 130 gallons. This was accomplished by metering about 5,000 consumers of a total of 49,000, and while the effect is marked, the per capita supply still shows large waste and can be reduced by increasing the number of meters.

The increase in the use of meters in Washington has had a similar but no less marked effect. The existing law requires the use of meters only by hotels, livery stables, manufacturing establishments and other large consumers. Since 1894 all such consumers have been required to use meters. With an increase since 1894 of 4,355 in the number of premises supplied with water, the total daily supply is reduced about 4,000,000 gallons and the per capita supply from 181 to 164 gallons. This can be attributed to no other cause than the metering of about 500 large consumers of the above named character. Superintendent Illig makes comparisons as follows:

Milwaukee, with a population of 280,000, has 25,689 meters and per capita consumption of 85 gallons; Toronto, population 200,000, has 17,000 meters and a per capita consumption of 95 gallons; Toledo, 135,000 population, has 4,297 meters and a per capita consumption of 54 gallons; Buffalo, with an estimated population of 400,000, has 114 meters and a per capita consumption of 273 gallons.

Raising a Water Main Under Pressure in Louisville.

The raising of a 30-in. water main under pressure a maximum hight of 9-ft., was accomplished recently at Louisville, Ky., under the direction of Charles Hermany, chief engineer and superintendent of the Louisville Water company. The work was done as follows: Fifteen pairs of transverse beams were laid across the trench above consecutive joints, and supported over the pipe by short longitudinal blocks on each of which a fifteen-ton jack was set. On top of each jack was hung a long U-shaped stirrup which had its lower ends hooked into the upper ends of saddle bars engaging the pipe. The pipe was raised a few inches at a time by the simultaneous operation of the jacks, and the earth was backfilled and tamped under it as fast as it was raised. The displacement was checked and regulated by observations of vertical scales set on the pipe and intersected by the edges of the horizontal cross-beams. It took a gang of fifty men the equivalent of three weeks to do the work, including the time on excavation of the trench and backfilling.

Conviction for Chicago Stock Yards Water Thefts.

Harry Boore, superintendent of the Continental Packing & Provision company, Chicago, Ill., was found guilty, Feb. 18, of stealing 187,000 gallons of water from the city mains in the stock yards for the use of the packing company. The value of the water was fixed at $14.96. This sentence will be for petit larceny, the punishment for which is a fine not to exceed $1,000 and imprisonment not to exceed one year. The trial and conviction of Boore was the first resulting from a recent examination of the city water mains in the stock yards district, in which it was discovered that the mains had been illicitly tapped in many places, and millions of gallons of water taken.

Experiments with Septic Tanks in Pawtucket, R. I.

A record of investigations of the septic-tank treatment of sewage is given in the anuual report for 1900 of George A. Carpenter, city engineer of Pawtucket, R. I. The works were built by Mr. Carpenter several years ago and their operation began Dec. 1, 1894. The sewage filtered daily has increased from an average of 58,200 gallons in 1895 to 92,800 gallons in 1900, an increase of about 62 per cent. The actual filtering area on Jan. 1, 1895, was 1,648 acres. In August, 1895, 0.256 acre was added, and in November, 0,437 acre, bringing the total up to 2.34 acres. The area has not been increased since Nov. 1, 1895, except by two experimental beds, which have a surface area of 1-200 acre each. The maximum daily average for a single month has increased in the same ratio from 82,548 gallons in 1895 to 132,622 gallons in 1900. These figures indicate that at times the beds have to deal with over 40 per cent. more than the average daily flow for the year, and this in-

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creased amount of the sewage always occurs in the colder months, when the beds, on account of climatic influences, are not in the best condition for dealing with the greatest quantity of which they are capable.

The application of sewage to the beds has been at the rate of 100,000 gallons per acre, and the beds have been used in rotation. In January, 1900, when filtering the largest amount of sewage, most of the beds were used twice in three days, thus making the average daily dose 66,666 gallons per acre. In the winter months this heavy dosing, with the present system of underdrains, one line of 4-inch tile pipe in the berm dividing two beds, keeps the beds pretty thoroughly saturated.

An appropriation was obtained from the city council in July, 1900, and four of the beds were supplied with additional underdrains. Across each of these four beds two additional lines of 4-in tile were laid about 20 ft. apart. The total width of these four beds is about 60 ft. Although the effluent now passed through the beds more rapidly than formerly, the analyses show that the quality has not deteriorated. In order to ascertain how much they can purify in a satisfactory manner during the winter season, sewage is now supplied to these four beds every day except Sunday. The work of the sand filters has been highly satisfactory during the whole of the six years that they have been in operation, and an effluent much better than the river into which it flows has been obtained.

The sewage is received in two tanks 130x 100 ft.x3 ft. deep, and after a tank has filled the upper 2.5 feet is discharged on the sand beds, and the lower 6 inches which represents a somewhat heavier sewage, on account of sedimentation, is let out on what are termed sludge beds. These sludge beds are similar to the other sand beds only they are somewhat smaller. The heavier matter in the sewage retained on the surface of these sludge beds is dried and raked up and wheeled away to a compost heap. Measurements of the dried sludge removed from the surface of these beds have shown that, after thoroughly compacting by ramming, it amounts to about 3.15 cubic yards per million gallons of sewage received in the tanks. On the surface of the other sand beds there is very little accumulation, and the discolored sand is scraped off and removed about twice each year.

For the purpose of ascertaining how much sludge would accumulate in a septic tank, how often it would have to be removed, what its character would be, how much it would cost to remove it, and what effect the effluent from the sludge beds would have on the sand filters, one of the receiving tanks was turned into a septic tank on Jan. 13, 1900, and has been used as such ever since. No change was made in the tank except to provide an overflow which would take the effluent from the tank about 17 ins. below the surface and discharge it into the other tank. The analyses show that 41.5 per cent. of the organic matter, as represented by the albuminoid ammonia, has been removed by the septic tank. The analyses also indicate, by a comparison of the total residue on evaporation, that 37.733 parts per 100,000, or 1.868 cu. yds. of mineral matter per million gallons of sewage have been left in the septic tank.

Mr. Carpenter states that after ten months' operation of the septic tank the sewage in this tank was drawn off, the sludge carefully measured, loaded into barrows and wheeled about two hundred feet to a field where it was taken by a farmer, spread on the surface and plowed in. The amount of sludge which had accumulated in ten months was 152.17 cubic yards. About 4.69 cubic yards of this was sand which had collected near the inlet, which left 147.18 cubic yards as the amount of sludge collected from 27,166,000 gallons of sewage, or 5,428 cubic yards per million gallons. Analysis of the sludge shows 81.75 per cent. of water, which leaves but 26,915 cubic yards, or 0.99 cubic yards per million gallons, as the actual amount of mineral and organic matter left in the tank. This would indicate that the septic action, in some manner, disposed of the difference between 1,865 cubic yards per million gallons and this amount. This difference is 0.878 cubic yards per million gallons, or 23.85 cubic yards for the ten months the tank was in service. The cost of removing this sludge was $62.87, or $0.41 1-3 per cubic yard. The cost of scraping the surface of the sludge beds, on which the sewage from the septic tank was turned when it was emptied, which amounted to $7.07, should be added to this, making the total cost of cleaning $69.94, or $0.459 per cubic yard.

These tanks are covered with a pitched roof boarded and shingled and provided with ventilators, but no disagreeable odors emanated from the septic tank. There was a large amount of gas given off by the effluent from the septic tank as it discharged into the second or collecting tank, and as it was again discharged from there to the beds, but nothing that could be termed a nuisance or that would be very marked 500 feet distant from the plant.

For experimental work in connection with the septic tank two bacterial filters were constructed, each 15 by 15.5 feet by 4 feet deep. On the bottom of each filter were placed two rows of 2-inch tile underdrains about 5 feet apart. These pipes were surrounded and covered with clean gravel of assorted sizes with fine white roofing gravel for the top layer. The total depth of the gravel was 8 inches. On top of this gravel in one bed, No. 14, 3 feet and 4 inches of

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crushed stone of the size known as chestnut were placed. In the other bed, No. 15, 3 feet 4 inches of soft coal cinder which would pass through a screen of 1-inch mesh but would be rejected by a screen of ½-inch mesh, were deposited. On these two beds sewage from the septic tank has been turned each week day since March 12, 1900, at the rate of about 527,000 gallons per acre, or about 100 gallons per cubic yard of filtering material in the beds.

The following table gives the averages of chemical examinations made by the State Board of Health from April 16 to October 1, 1900:

AVERAGES OF CHEMICAL EXAMINATIONS MADE BY THE STATE BOARD OF HEALTH FROM APRIL 16 TO OCTOBER 1, 1900. (PARTS PER 100,000.)

	Residue on Evaporation.			Ammonia.				Chlorine.	Nitrogen as		
					Albuminoid.						
	Total.	Loss on Ignition.	Fixed.	Free.	Total.	In Solution.	In Suspension.		Nitrates.	Nitrites.	Oxygen Consumed.
Sewage, average of 18 analyses	102.017	59.889	42.128	7.811	1.442	0.805	0.637	11.073	.....	.....	17.572
Septic sewage, average of 20 tests	64.990	32.425	32.565	7.595	0.846	0.621	0.225	9.556	.....	.....	8.525
Effluent of sand filters, av. of 13 tests.	49.223	17.461	31.762	1.432	0.083	0.061	0.022	8.856	2.6750	0.0426	1.073
Effluent of bact. filter 14, av. of 9 tests.	49.911	17.244	32.667	4.777	0.434	0.296	0.138	9.819	0.0153	.....	4.222
Effluent of bact. filter 15, av. of 9 tests.	47.922	15.089	32.833	4.444	0.414	0.288	0.126	9.772	0.0157	.....	3.583
Percentage improvement by:											
Septic tank	.....	.....	.....	2.7	41.3	.....	.....	.....	.....	.....	51.5
Septic tank and sand filter	.....	.....	.....	81.7	94.2	.....	.....	.....	.....	.....	98.9
Septic tank and filter 14	.....	.....	.....	38.8	69.9	.....	.....	.....	.....	.....	76.0
Septic tank and filter 15	.....	.....	.....	43.1	71.3	.....	.....	.....	.....	.....	79.9

The analyses indicate that the effluent from bed No. 15 contains 51.1 per cent. less albuminoid ammonia than the septic effluent, or 71.3 per cent. less than the original sewage, and that nitrification has been established.

On Sept. 11, 1900, experiments in the aeration of the septic sewage applied to both beds were begun. This septic sewage was pumped to a hight of about twelve feet and allowed to fall through three screens of one-eighth-inch mesh placed two feet apart to the distributing well, from which it was run to the beds. The result of this aeration was the introduction of 50 per cent. of dissolved oxygen into the sewage.

A slight improvement in the effluent has been noticed. Two smaller bacterial filters have been constructed by filling two cans twenty inches in diameter and six feet high with filtering material, one with coke and the other with cinders similar to bed No. 15, and the effluent from bed No. 15 has been turned on these.

Although it is too early to give the results of any large number of analyses of the effluent from the new filters, those that have been made show a reduction in the albuminoid ammonia and an increase in nitrates to 1.48 parts per 100,000.

Frequency of Discharge of Flush Tanks.

I have read from time to time articles about flush tanks and how often they should be discharged. We have thirty automatic flush tanks on our sewer system.

When I took charge of this system of sewers in connection with the water works I found the tanks were discharging in some instances twice an hour. The regulation was accomplished by the ordinary rough stopcock. The water had cut the core of many of them so they would not shut off the supply. It was quite plain to me that some other means of regulating the supply should be adopted. I concluded that a jet was the surest way to feed the tank, and for this purpose I used a ¾-inch cast iron plug with a whole drilled through it of varying size but about 1-16 of an inch in diameter.

The plug is screwed into a T, one opening of the T being connected to the pipe inside the tank, the other one having a ¾-inch rough stop cock attached from which a handle extends to near the top of the tank within reach. The tanks are examined about once in three weeks, and in order to see that they are operating, the rough stop is opened, the tank thus filling quickly.

My experience with tanks on our system is that in order to keep them in continuous operation they should be discharged not less than three times daily (24 hrs.). While perhaps the sewer may not require flushing that often, yet in order that the tank shall work continuously, which is fully as important, I find this rate is necessary. It is an easy matter to get the proper flow into the tanks by the size of the hole in the plug. They are inexpensive, and after a few trials the proper size can be determined. Since adopting this system we have had no trouble and the quantity of water used is greatly reduced.

The trouble in not being able to discharge the tanks less than three times daily is not due to the failure in the water supply, but in the siphon failing to act. The water rises in the tank to the level of the long limb or a little higher and unless the supply is increased it will fail to discharge. Naturally one would look for a leak in the tank, but this is not the case, as I examined the tanks for leaks. I found water running from the outlet pipe of the siphon. I have never fully satisfied myself what was the real cause of this action, but I have sometimes thought that it was caused by the air escaping from the bell through some leak, thus destroying the operating feature of the tank. I have another theory to offer on which I hope someone will express his opinion. This theory is that the water rises in the bell to near the top of the long limb. A thin fillet of water around

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the outer edge of the long limb, due to capillary attraction, is a little in advance of the main column of water; this water flows over the edge of the long limb and down the inner edge of the limb without displacing any of the confined air in the bell and limb, thus running into the outlet pipe. The trouble with the supply pipe clogging up, it seems to me, would be in a measure overcome by the inspecting of the tanks, as the opening of the stop-cock full open each time would flush out the pipe.

Within the last year I have had some trouble with roots in sewer pipe, mostly from elm and willow trees. To remove them I used a flat piece of steel formed in a spiral, the edge of the bar being sharpened. It has worked admirably. These little wrinkles may be old to most of your readers. However, I offer them, hoping they will be of interest to someone who may be in the same predicament I have been.

EDWARD M. LAING.
Supt. Water Works and Sewers, Highland Park, Ill.

This letter from a correspondent and subscriber is an interesting contribution to the discussion on the waste of water by flush tanks. It is probable that the design of the flush tank or some small error in the detail of setting is responsible for the failure of the tank to discharge when the supply of water is very small. There are tanks so designed that when properly set they will discharge when full, no matter what the rate of flow of the supplying stream, but almost any tank, if not properly set, will be subject to the failure of discharge with small stream for one or the other of the reasons mentioned by him.

Dady's Havana Claims Settled.

The payment of $250,000 to Michael J. Dady, Jan. 29, settles the controversy between Mr. Dady and the military and municipal governments of Havana, Cuba, regarding the contract for paving the sewers in that city. Mr. Dady gave a bond of similar amount that he was authorized on behalf of the Dady company to make the settlement and to release all claims.

Preliminary Supreme Court Decision on Stream Pollution by Chicago Drainage Canal.

The United States supreme court rendered a decision Jan. 28, in the case of the state of Missouri vs. the Sanitary district of Chicago, in which it was held that the city of St. Louis must be given an opportunity to come into court and show that the operation of the drainage canal will pollute that city's water supply. The sanitary district of Chicago expended $34,000,000 in building the drainage canal, which was objected to by the city of St. Louis on the ground that the filth of the Chicago river would be carried through the Desplaines and Illinois rivers and thence down the Mississippi, to pollute the city's water supply. The sanitary district contends that flowing water purifies itself by the principle of oxidation, and it will stand or fall on this principle.

The opinion was handed down through Justice Shiras, who said that two questions are presented in the case. The first is "whether the allegations of the bill disclose a case of controversy between the state of Missouri and the state of Illinois and a citizen thereof within the meaning of the constitution and the statutes of the United States which create and define the original jurisdiction of this court;" the second, "whether if it be held that the allegations of the bill do present such a controversy they are sufficient to entitle the state of Missouri to the equitable relief prayed for." Regarding the first question, the court concludes:

An inspection of the bill discloses that the nature of the injury complained of (the pollution of the drinking water of people of Missouri by the deposit of the sewage of Chicago into the Mississippi river through the drainage canal and the Illinois river) is such that an adequate remedy can only be found in this court at the suit of the state of Missouri. It is true that no question of boundary is involved nor of direct property rights belonging to the complainant state. But it must surely be conceded that if the health and comfort of the inhabitants of a state are threatened the state is the proper party to represent and defend them. * * * The health and comfort of large communities inhabiting those parts of the state situated on the Mississippi river are not alone concerned, but contagious and typhoidal diseases introduced into river communities may spread themselves throughout the territory of the state. Moreover, substantial impairment of the health and prosperity of the towns and cities of the state situated on the Mississippi, including its commercial metropolis, would injuriously affect the entire state.

That suits brought by individuals, each for personal injuries, threatened or received, would be wholly inadequate and disproportional remedies requires no argument.

On the point that Illinois should not have been made a party to the bill and that the sanitary district of Chicago should have been made the only defendant, he says:

The bill does not allege that the sanitary district is acting without or in excess of lawful authority. The averment and the conceded facts are that the corporation is an agency of the state to do the very things which, according to the theory of the complainant's case, will result in the mischief to be apprehended. The sanitary district of Chicago is not a private corporation formed for the purpose of private gain, but a public corporation whose existence and operations are wholly within the control of the state. The object of the bill is to subject the public work to judicial supervision upon the allegation that the method of its construction and maintenance will create a continuing nuisance, dangerous to the health of a neighboring state and its inhabitants. Surely in such a case the state of Illinois would have a right to appear and traverse the allegations of the

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bill, and, having such a right, might properly be made a defendant.

Regarding the second question he says:

Can it be gravely contended that there are no preventive remedies by way of injunction or otherwise against injuries inflicted or experienced but which would appear to be the natural result of acts of the defendant, which he admits or avows it to be his intention to commit?

Our conclusion therefore is that the demurrers filed by the respective defendants cannot be sustained. We do not wish to be understood as holding that in a case like the present one, where the injuries complained of grow out of the prosecution of a public work authorized by law a court of equity ought to interpose by way of preliminary or interlocutory injunction, when it is denied by answer that there is any reasonable foundation for the charges contained in the bill.

We are dealing with the case of a bill alleging in explicit terms that damage and irreparable injury will naturally and necessarily be occasioned by acts of the defendants, and where the defendants have chosen to have their rights disposed of, so far as the present hearing is concerned, upon the assertions of this bill. We fully agree with the contention that it is settled that an injunction to restrain a nuisance will issue only in cases where the fact of the nuisance is made out upon determinate and satisfactory evidence; that, if the evidence be conflicting and the injury be doubtful, that conflict and doubt will be ground for withholding an injunction, and that, where interposition by injunction is sought to restrain that which is apprehended will create a nuisance of which its complainant may complain, the proofs must show such a state of facts as will manifest the danger to be real and immediate. But such observations are not relevant to the case as it is now before us.

The demurrers are overruled and leave is given to the defendant to file answers to the bill.

The ruling of the court seems to give cause for gratification to both sides, for each claims that the contention will now be tried on its merits.

The Grade Crossing Question in Cleveland.

A special committee of the Chamber of Commerce, Cleveland, O., has submitted a report on the abolition of grade crossings in that city. The committee reports that there are 135 crossings of steam railways with streets at grade, of which twenty-nine are in streets bearing street railways, twenty-nine on main streets without surface railways and the remaining seventy-eight are on streets with comparatively light traffic. Observations were made at three important crossings and the result was given in the report in the form of a census, by hours, and for twenty-four hours of an average day. At the combined Euclid-ave. and Willson-ave. crossing, during twenty-four hours, 9,831 pedestrians, 6,020 ordinary vehicles, and 1,303 street cars, crossed the railway tracks. The two classes of vehicles contained a total of 33,119 passengers. The committee noticed delays caused to pedestrians and passengers at this combined crossing, with the following conclusions:

Each street railway car is delayed half a minute on account of the crossing, either on the Euclid or Willson lines, during an average day of seventeen hours; and 100 trains delay traffic a total of two hours and eighteen minutes, or one and one-third minutes per train. It is thus found that 1,207 pedestrians, 740 vehicles and 4,068 passengers were delayed one and one-third minutes each on account of trains, at a cost of $19.964; also that 33,119 passengers were delayed one-half minute each, at a cost of $27.654; a total cost of $47.618 per day, which in one year amounts to $17,380.57, or 5 per cent. on about $350,000.

At the other two crossings the delays, when capitalized, would warrant the expenditure of $106,000 for Detroit-st., and $142,500 for Pearl-st. Railway companies in Ohio cannot be compelled, under existing laws, to aoblish grade crossings, but in case an agreement for such action is reached the law requires steam railways to pay not less than 65 per cent. of the cost and prohibits municipalities from paying more than 35 per cent. Street railways are not compelled to pay a cent. In conclusion the committee makes the following recommendations:

1. That the legislature be requested to pass a law requiring street railroads to pay not less than 25 per cent. of the expenses of abolishing grade crossings used by them.

2. That the legislature also be requested to pass a law providing for the appointment of a grade crossing commission, to be composed of the governor, auditor of state and commissioner of railroads, who shall have authority in event of its satisfactorily being made to appear to them that a municipality has been unable to agree with any railroad company with respect to the abolishment of its grade crossings, to determine, after full hearing being given the parties interested, as to the necessity of abolishing such crossings and as to the terms and conditions upon which the same should be done, including the apportionment of the cost thereof upon the parties interested.

3. That the mayor be requested to appoint a committee of seven representative citizens, who shall serve without compensation, to consider and report plans for the abolishment of all grade crossings in this city, and to confer with the proper representatives of the various steam and street railroad companies with a view to inducing them to agree upon the adoption of mutually satisfactory plans and to contribute their just proportion to the cost of making such improvements.

4. That to pay the legitimate expenses of such committee, including the expenses of employing competent engineers to make the necessary surveys and prepare plans and estimates to that end, the council be requested to appropriate the sum of $10,000.

Report of Massachusetts Topographical Commission.

In its report to the governor, the Massachusetts topographical commission estimates that it will require eight or ten years more to complete the topographical work in the state. Massachusetts is the first state

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to undertake this work on so complete a scale, and many vexed questions of boundary lines have already been determined and disputes settled. The boundaries between Massachusetts, New York and Rhode Island are also being marked. The commission, which serves without pay, is composed of the following: Desmond Fitzgerald, chief engineer of the Metropolitan Water Board; A. E. Burton of the Massachusetts Institute of Technology; Frank W. Hodgson, engineer of the harbor and land commission.

Proposed Insertion of Contractor's Label in Chicago Pavements.

An ordinance approved by the special assessment committee of the Chicago city council Jan. 31 provides for protection against contractors in the following manner: "A plate of burnished steel, to be not smaller than 6 by 15 inches, nor larger than 10 by 24 inches, will hereafter be placed at the intersections of newly paved streets. The plate will set forth the name of the street, the date of the completion of the work of paving, the date of the expiration of the guaranty made by the contractor to the property-owners, the name of the contractor and the following inscription: Report defects or needed improvements to the commissioner of public works, city hall." Alderman Fowler is the originator of the idea.

Paving Commission Proposed for New Haven.

A bill will be introduced in the Connecticut legislature providing for a paving commission for New Haven. The bill provides that the paving commission shall consist of five men, of which three shall be appointed by the mayor, one by the Board of Aldermen and one by the Board of Councilmen. The members of the commission are to serve without pay, but a clerk is provided for at a salary not to exceed $500. The clerk will be appointed by the commission. The commission will have nothing to do with crushed stone pavement, as it is not classed as permanent pavement, but will only have power over the laying of permanent pavements, such as brick or asphalt.

New Jersey Road System.

A report on the New Jersey road system was prepared for the Springfield union recently by William L. Dickinson of Springfield, Mass., president of the Connecticut Valley Highway association. Mr. Dickinson, who practically lived with the men who make the roads and with the people who have to pay for making them, has gathered the following interesting facts:

New Jersey state aid law in operation since 1891. Its satisfactory working has caused other states to adopt it. System praised by United States road inquiry board. One hundred and sixty miles of splendid state road between Jersey City and Atlantic City. State has not incurred a debt in giving road aid to towns.

Four hundred and forty miles of state road built prior to Jan. 1, 1900, at a total cost of $2,200,000, or about $5,000 a mile. Of this amount the state paid $716,000, the counties paying the remainder. Some roads, ten feet wide and with eight inches of crushed stone, have been built for $3,000 a mile. Many miles of fourteen-foot roads have been built for $4,000 a mile. In some sections thin macadam roads have been built for $1,500 a mile. Cost of some of the first roads was $9,000 a mile, which careful management has gradually reduced to the present low cost.

Particular attention paid to the reduction of grades, especially in the hilly section of the state.

State road laws provide for a supervisor in each county. These supervisors are practical road builders. They work under the general direction of the state commissioner, Henry I. Budd.

Cost of the roads has not been a burden. They have increased both the valuation and population of the state.

State road commissioner spends one day each week in his office in Trenton and devotes the rest of his time to inspecting and supervising the work. He has one assistant in this work. His office force consists of one clerk.

Mr. Dickinson says the building of continuous stretches has been found to be the most economical. The longest continuous line built in 1900 was 23.26 miles, and the largest mileage built in any one section was 34.34 miles. The cost for 1900 shows a slight increase on account of the advance in price of crushed stone, resulting from the combination of the different firms dealing in the material. The railroads also charge more for transportation. There is an absence of suitable stone for macadamizing in many sections of the state, and the crushed stone has to be carried by rail a long distance. The stone oftentimes costs $1.50 per ton delivered on the railroad, and it costs 25 to 50 cents per ton to deliver this where the work is to be done. This brings the cost of the roads up very materially; so do deep cuts made to reduce the grades and underdrains used to secure proper drainage. Different methods and materials have been used according to the conditions existing in the different localities.

Public Improvements in Indianapolis.

The reports of the boards of public works, public safety, health, the city police and fire surgeon, and the veterinarian of Indianapolis, Ind., were submitted to Mayor Taggart Feb. 4. The board of public works makes a number of recommendations, including the following: A municipal asphalt repair plant; that the electric lighting contract, which expires in 1903, be taken up this year that there will be no embarrassment if the present company is not the successful bidder; that Pogue's run and the state

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ditch be cleaned. Attention is called to the decrease in public improvements last year on account of the litigation which stopped improvements for six months. The report says:

The whole matter of sewers will be brought to the attention of our representatives in the general assembly, and it is confidently hoped that proper relief may be granted. In this event, it is also our intention to provide West Indianapolis with an adequate system of sewers.

The board believes that the street railway system compares favorably with that of any city in the union. Regarding the repair of permanently improved streets the report says:

There was placed at the disposal of the board for this purpose the sum of $25,000, and there was expended of this sum $17,807.46. Repairs were made where, in the judgment of the board, they were absolutely necessary, but it might be added that the whole amount of the sum appropriated, and much more, could have been used had all the requests made upon us for this purpose been heeded.

This problem is destined to become a serious and perplexing one, as the necessity of the work is sure to grow with the expiration of the contractors' guarantees. It is the opinion of the board that the city's interests (so far at least as asphalt repairs are concerned) can best be subserved in this matter by securing an asphalt repair plant, and it is the intention of the board to give this phase of the situation some thought and consideration.

For sweeping and cleaning improved streets the sum of $50,000 was appropriated, out of which must come the pay of inspectors, amounting to $1,920 annually. The report says it was found that this sum would not be sufficient to do the work as thoroughly, i. e., to scrape the streets and sweep them as often as necessary, but the best possible schedule under the circumstances was arranged, and while at intervals the streets were not as clean as might have been desired, when the number of miles of surface to be kept clean is compared with the sum appropriated for the purpose, we believe that the board has every reason to felicitate itself upon its success in keeping the streets in the good condition in which they were kept and yet live within the appropriation.

Under the provisions of a legislative enactment the unimproved streets were, so far as possible, sprinkled at the expense of the municipality. The sum of $40,000 was appropriated for the purpose, from which the salary of one inspector must be deducted.

The annual report of B. J. T. Jeup, city engineer of Indianapolis, Ind., for 1900 sets out in detail all the work accomplished in his department, not only for that year, but during the last ten years. He states that the improvements contemplated during 1900 were delayed on account of the decision of the Federal court, which held that the Barrett law is invalid. Later the supreme court upheld the law, but the delay caused a postponement of many of the improvements contemplated earlier in the year. During the year .72 mls. of asphalt, 1.24 mls. of brick and 9.2 mls. of wooden block pavement were laid and 7½ mls. of sewers were constructed. In 1899, 9.37 mls. of sewers were constructed. The report says an amendment to the city charter provisions on sewers has been proposed governing the methods by which assessments are to be made for the construction of large sewers. The present charter is defective in that it provides that in the construction of large sewers the assessment per unit of area is equal over the entire district drained by the sewer. The proposed amendment provides that the board of works shall have power to make assessments according to actual benefits received by each piece of property included in a district. The report states that 7.34 mls. of cement sidewalks were laid and a number of streets were resurfaced and repaired during the year.

The improvements accomplished during the last ten years are as follows:

Area of Indianapolis in square miles	27.09
Miles of streets and alleys paved with asphalt	41.66
Miles of streets and alleys paved with brick	24.27
Miles of streets and alleys paved with creosoted pine blocks	7.99
Miles of streets paved with round cedar blocks	.54
Miles of streets paved with Washington cedar blocks	3.06
Miles of streets paved with Washington cedar blocks not creosoted	1.86
Miles of streets paved with macadam	4.04
Total	83.32
Miles of sewers	98.60
Miles conduit laid:	
Indianapolis Light and Power Co	17.75
Central Union Telephone Co	4.99
New Telephone Co	5.34
Western Union Telegraph Co	3.53
Total	31.61
Number electric lights in city	1,226
Number vapor lights	259
Number gas lights	142
Miles street railway lines	125

The following table shows the total number of miles of improvements and the aggregate cost for ten years:

	Miles.	Cost.
Asphalt	41.56	$2,560,625 31
Asphalt repaved	.77	69,004 02
Brick	24.27	932,476 36
Wooden block	13.35	757,270 77
Macadam	3.70	154,522 91
Gravel streets	75.50	657,648 02
Gravel alleys	11.92	33,274 09
Bowldered alleys	4.77	11,990 09
Cement walks	125.08	608,414 42
Brick walks	25.99	65,995 41
Sewers	98.60	1,627,385 31
Levees		17,725 46
Bridges		185,804 81
Total		$7,669,136 98

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Utilization of Refuse and Garbage for Fuel in England.

The utilization of refuse in connection with electrical schemes is embodied in a report which has just been prepared by F. W. Brookman, manager of the Rochdale (England) sanitary works. The municipal electricity works at Rochdale have been in use only a few months, and arrangements have now been made for the production of current for the tramways, which the corporation will soon take over from the existing company. Both the gas and electricity works are in charge of one committee. It it believed that the committee's intention is to extend the plant at the present generating station so as to be able to supply the current that may be required for all purposes. Mr. Brookman, in his report opposes this view, and advises a separate power station for tramways at the sanitary works, where the refuse might be fully used as fuel. Rochdale was one of the first towns to use refuse systematically for the generation of steam. Mr. Brookman says that about ten years ago a number of towns had destructors in operation which burned refuse, but the number which got any appreciable amount of power out of it could be counted on the fingers of one hand. With the coming of the high temperature furnace great power was quickly made, and destructors now provide for all kinds of work, including the following:

Electric lighting, electric traction, mortar mills, working baths and bathhouses, making bricks and slabs, pumping water for town's supply, working pressing plant for sewage sludge, etc.

Refuse is burned for one or other of these purposes at the following, and many other places: Canterbury, Leeds, Colne, Huddersfield, Dewsbury, Sheffield, Fleetwood, Leicester, Llandudno, Ashton, Leyton, Birmingham, Rotherhithe, Manchester, Streatham, Nottingham, St. Helens, Stretford, Liverpool, Warrington, Glasgow, Wimbledon, Aldershot, Burton, Shoreditch, Blackburn, Southampton, Darwen, Bradford, Hereford, Oldham, Hunstanton, Edinburgh, Shipley.

Mr. Brookman says that plants of various sizes and for various purposes are being made by the dozen at the present time. At Rochdale the excreta have been manufactured into manure for many years, and for a long while had a ready sale in agricultural districts. The demand has fallen off of late, however, and Mr. Brookman says it is only a question of time when the manufacture will be entirely stopped. When that time arrives the refuse that is now burned to generate steam for the manure manufacturing process will be wholly available for other purposes. Detailed reports are given of tests made at Rochdale, St. Helens, Darwen and Nelson, which, he says, prove conclusively that not only can unscreened refuse and foul garbage be completely burned without creating any nuisance, and producing a hard, dry clinker suitable for many purposes, but that such refuse is a valuable source of power. The estimate of Lacey & Co., that six pounds of refuse are equal to one pound of coal at 7s per ton, is accepted by Mr. Brookman. At the Rochdale Sanitary works about 20,000 tons of refuse are received every year, the fuel value of which is thus equal to 3,333 tons of coal. Not only would this be wasted, but it would cost in labor alone nearly £1,000 to waste it, unless the burning process could be made to serve some useful purpose. Mr. Brookman says:

While we are paying £1,000 per annum to waste the equivilent of 3,333 tons of coal (which is worth considerably over another £1,000), if the tramways committee obtain the electrical energy they require from the present electrical works, the electricity committee will purchase not less than another £1,000 worth of coal to generate the energy required to work the trams, and will, of course, employ labor to burn this totally unnecessary quantity of coal.

He contends that, even apart from the advantage to be derived from the utilization of refuse as fuel, it is economical to have a separate power station for the tramways. Mr. Brookman has been through the accounts of 74 local authorities who have generating stations, and he finds the average cost of coal to be .76d per unit sold. The average cost of the management and office expenses, insurance, etc., is, on the other hand, only .453d per unit sold.

Meeting of Indiana Engineering Society.

The twenty-first annual meeting of the Indiana Engineering Society, held at Indianapolis Feb. 14, 15 and 16, was an interesting and successful meeting notwithstanding the prolonged illness of the secretary, his work being assumed and ably carried out by President J. S. Spiker. The engineering field was well covered by the papers presented, and liberal selection from them will appear in our columns. The session of the afternoon of the 15th was devoted to cement and concrete and was more than usually interesting, including papers on "The Manufacture of Portland Cement," by S. B. Newberry; "The Strength of American Slag Cement," by Prof. W. K. Hatt; "Concrete Construction As a Substitute for Brick and Stone Masonry," by Victor K. Hendricks, Engineer Maintenance of Way, T. H. & L. R. R. These were all practical papers by experts in the respective subjects.

Important papers were those on "Stream Pollution," by A. J. Hammond, formerly a city engineer, and on "Sewage Disposal," by F. A. Barbour, civil engineer. These were of special interest in view of the bills now before the Indiana legislature on the subject. One of these bills was prepared by

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the state board of health and provides for a careful and scientific study of each particular case as it arises and an intelligent supervision of the streams of the state. After a careful consideration of this bill the society adopted a resolution favoring its passage. Another bill, which has already passed the senate, provides for a written permission, limited as to duration, to be issued by the state board of health to any one proposing to pollute a stream, such permission being a bar to any liability for damages unless specific damage can be proved in an action at law. This bill fails to provide the proper machinery for the state board of health to prepare and to enforce its decisions, and while the society considered its indorsement of the former bill sufficient formal action, members expressed themselves as opposed to the latter bill owing to its fragmentary and unscientific character and the possibility of serious errors in its practical application.

Other valuable papers were those on "Street Paving," by John Finan, jr.; "The Mississippi River Commission Surveys," by Prof. C. V. Seastone; "Railroading in Great Britain," by Prof. R. L. Sackett; "Relations of Engineer and Contractor," by R. L. Bailey; "The Design and Construction of Masonry Arches," by Prof. W. D. Pence; "The Condition of Engineering Work in Lebanon," by John W. Fulwider.

The officers elected are; President, Prof. W. D. Pence, Purdue University, Lafayette; Vice-President, Prof. R. D. Sackett, Earlham College, Richmond; Secretary and Treasurer, Charles Carroll Brown, Editor Municipal Engineering, Indianapolis. Directors: J. S. Spiker, Civil Engineer, Vincennes; F. W. Keller, County Surveyor, South Bend; C. G. H. Goss, Civil Engineer, Martinsville.

Cedar Rapids Water Cases.

The contract of the city of Cedar Rapids with the water company expired Feb. 19, 1900. The city failed to pay its hydrant rental for 1899 and 1900 and the water company obtained judgment for the amount. An attempt to regulate water rates before the contract expired was prevented by injunction, the court holding that the fixing of rates was a matter of contract and could not be done by one party only.

The city had plans for a municipal system prepared, but found the cost was greater than it was allowed to raise, as the amount required would cause the city's indebtedness to pass the limit.

An ordinance was then passed and submitted to the people, proposing to grant a franchise to J. H. Brown and agreeing to pay him $38,000 a year for hydrant rental, other water for public purposes to be furnished without charge, these payments to continue for twenty-five years, when the works would become the property of the city. This proposition was favorably passed upon by the voters, but in taking the final steps in the council the clause turning the works over to the city at the end of the period named was dropped out. Suit was brought to enjoin the council from completing the contract and the decision of Judge Treichler was rendered Feb. 16 declaring the franchise unreasonable, illegal and void and restraining the city from making any contract under it. The amount heretofore paid for all public serivces has been not more than $16,527 a year, and there has been no complaint of inadequate compensation. Under the Brown franchise the rate to private consumers would have been lowered materially, and the present water company resists the reduction of rates to the same figures without the compensating increase in hydrant rentals offered the Brown company.

Report of Filtration of Water Supply for Washington, D. C.

A report on the purification of the Potomac river water for the supply of the District of Columbia was submitted to the Senate District committee, Feb. 19, by Messrs. Rudolph Hering, George W. Fuller and Allen Hazen. The use of slow sand filters with auxiliary works for preliminary sedimentation and the use of a coagulant part of the time according to the modified English system is recommended. Regarding the plans already made, the report says:

"As to the relative merits of the two systems of purification studied by Colonel Miller, namely, the treatment of plain subsided waters by sand and mechanical filters, his conclusion is correct that the latter system would be the more efficient and the more judicious one for the City of Washington to adopt. Since his investigations were instituted, some improvements have been made in the general processes of both slow and rapid filtration. Relative to the former, this progress applies, for very turbid clay-bearing waters, when needed. This procedure was studied at length at Cincinnati and is used at a number of small places in Europe. It is referred to in Colonel Miller's report as the modified English system. It was not investigated by him owing to lack of funds, and in the absence of practical results he did not consider it."

The Venezuelan Asphalt Controversy.

On Feb. 20 the New York and Bermudez company, owning the first asphalt concession granted citizens of the United States by the government of Venezuela, filed a brief with the Department of State setting forth its claims. The company claims that the contention "is not between two American companies over a boundary line, but that the immediate parties are the government of Venezuela and the New York and Bermudez company, the former having attempted to sell to some of its citizens a right previously granted to the lat-

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ter. That the disputed title was purchased by American citizens does not affect the status of the case. There is a flagrant denial of justice which the United States is justified in interfering to prevent. The case should therefore be treated by international methods, thus removing it from the jurisdiction of the Venezuelan courts." The company asserts its desire to submit the case in its present state to an impartial international tribunal rather than ask the United States government to resort to extreme measures. The reply of the other parties interested in the disputed concession has not yet been received.

The Asphalt Situation.

Mr. George C. Warren of Utica, N. Y., formerly the general superintendent of the Warren-Scharf Asphalt Paving company, gives the following account of the combination of asphalt companies recently announced:

About a year and a half ago a syndicate consisting of Gen. Francis V. Greene, Amzi L. Barber, William L. Elkins, P. A. B. Widener and a few other capitalists bought controlling interests and subsequently all of the stock of the Warren-Scharf Asphalt Paving company, the Utica Paving company, the Barber Asphalt Paving company, the Columbia Construction company, the Alcatraz Asphalt company, the Western Paving and Supply company, the Pennsylvania Asphalt Paving company, the Gilson Asphaltum company of New Jersey, the New Jersey Mexican Asphalt company, the Manhattan Trap Rock company, and quite a number of other asphalt companies and their sub-companies. With this property in their possession, they organized the Asphalt company of America, with a paid-in capital of $3,000,000, which was subsequently increased to $6,000,000, and having also as assets the stock of all the companies purchased. The bonded indebtedness of the new company was $30,000,000. Within the past few months the Asphalt company of America was organized as the National Asphalt company. The Asphalt Paving company of America as such has laid no pavements, the work being done by its subcompanies. Some of the asphalts controlled by the National and its allies are the Trinidad, Pitch lake, Bermundez lake, Mexican, the several California asphalts known as Alcatraz, Standard and others, and the Seyssel, French asphalt. In Trinidad, in addition to the Pitch lake, the new company owns about nine-tenths of the town of La Brea, in which the so-called land asphalts are located. It is understood that by absorbing the many old companies the new company will dispense with the services of about two hundred former employes, retaining enough to do its work.

Prominent among the number are Mr. Warren himself, and Mr. S. Whinery, M. Am. Soc. C. E., for many years a vice-president of the Warren-Scharf Asphalt Paving company and its acting president during the transition period of the combination. The combination of local branches heretofore maintaining separate organizations materially reduces the expenses of the parent company and will enable them to do their work more economically.

C. M. Warner and P. R. Quinlan of Syracuse, the prime movers in the Columbia Construction company, which is one of the companies absorbed, have now obtained a concession from Venezuela to take asphalt from territory contiguous to that controlled by the Bermudez Asphalt company, also absorbed, and a contest over the boundary line between the concerns is now almost an international question.

The Warner-Quinlan company of Syracuse, the Cleveland Trinidad Paving company, or the newly incorporated Trinidad and Bermudez Asphalt company of Cleveland, the R. F. Conway company or the International Asphalt company, recently incorporated with Mr. Conway as a prominent member, of New York, are operating independently, and are equipped with material, apparatus and capital to continue in the field of competition.

Among the companies in independent operation, either for the supply of material or as contractors for work, are the Uvalde Asphalt company of New York, the Assyrian Asphalt company of Chicago, the Union Oil company of San Francisco, the Southern Refining company of Los Angeles, the Globe Asphalt company of Pittsburg, the United States Paving company, formerly the Boston Paving company of Boston; Jewett & Blodgett of Bakersfield, Cal.; Green River Asphalt company of Louisville, Ky.; Ayres Asphalt Paving company of Zanesville, O.; Sicilian Asphalt Paving company of New York, Southern Asphalt Paving company of New Orleans, La.; W. S. P. Shields of Philadelphia, and the Federal Asphalt company of Chicago.

Any statement of conditions in the asphalt field must be regarded as representing simply the best available information at the time. In addition to the changes in progress involving old companies, the plans as to new companies are likely to bring interesting developments in the near future, and further information may be expected in future issues.

Technical Meetings.

The eighth annual meeting of the Michigan gas association was held in Grand Rapids Feb. 20 and 21. The program included the following papers: "Neglected Opportunities," by B. C. Cobb, Detroit, Mich.; "Inclosed Cluster Lights With Self-Igniters," A. L. Zwisler, Kalamazoo, Mich.; "Street Maps; Their Use and Abuse," Paul Challis, Adrian, Mich.; "New Business," J. C. Sloan, Port Huron, Mich.; "The Relation of Heating and Illuminating Gases. Especially as Applied to Incandescent Mantles," Herman Russell.

The Western Society of Engineers held its

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regular meeting Feb. 8. Prof. Hermann Von Schrenk of the Shaw School of Botany, St. Louis, Mo., presented a paper on "Factors Which Cause the Decay in Wood," and H. P. Boardman of the Chicago & Alton railway presented one on "The Substitute for the Glasgow Bridge."

The Electrical Engineers' association of Syracuse university, Syracuse, N. Y., met Feb. 7 and reorganized the society on a new plan. H. R. Stevens, Fred Phillips, Geo. C. Carhart, R. W. Copeland and W. H. Squires were appointed a committee to draft a new constitution and to include certain qualifications for membership. Wesley L. Curtis was elected president and H. R. Stevens vice-president. The association will not be generally open to all electrical students hereafter, as it has this year. No students will be taken in during the first semester of their freshman year.

The twenty-first annual convention of the Iowa Brick and Tile association was held at Boone, Ia., Feb. 20 and 21.

The seventeenth annual meeting of the Ohio Gaslight association will be held in Dayton, O., March 20 and 21. F. C. Jones, secy., Delaware, O.

The Iowa Electrical association held its annual meeting in Des Moines, Ia., Feb. 20 and 21.

The annual convention of the Minnesota Surveyors' and Engineers' society was held in St. Paul Feb. 20 and 21.

The February meeting of the New England Water Works association was held in Boston Feb. 13. Attention was called by Wm. R. Grace, superintendent of the water works at Rockland, Mass., to a bill now before the Massachusetts legislature providing that unpaid water rates (due to a city or town) shall be a lien on the estate. He urged all who are interested to attend the hearing before a committee and present arguments for or against the measure. A review of "The Rise and Development of Water Supply Sanitation in the Nineteenth Century" was presented by Prof. Wm. T. Sedgwick of the Massachusetts Institute of Technology.

The regular monthly meeting of the Civil Engineers' Society of St. Paul, Minn., was held Feb. 4, 1901. The following officers were elected for the ensuing year: President, A. O. Powell, Asst. Eng. U. S.; Vice-President, A. W. Munster, Bridge Eng. C. G. W. Ry.; Secretary, G. S. Edmondstone, City Bridge Engineer; Treasurer, A. H. Hogeland, Res. Eng. G. N. Ry.; Librarian, C. A. Winslow, City Engr's office, St. Paul; Representative on Board of Managers for Association of Engineering societies, George L. Wilson, Asst. City Engineer, St. Paul. Mr. H. J. Gillie, superintendent Edison Electric Light company, described the terminal station within the city of St. Paul of the electric current generated at the power house of the St. Croix Water Power company at its dam upon Apple river.

A Small Gravity Sand Filter at Nyack, N. Y.

In a paper before the American Society of Civil Engineers, Mr. G. N. Houston, an associate member, presents a description of the construction of a small gravity sand filter for the villages of Nyack, South Nyack and Upper Nyack, N. Y., which have a combined population of about 8,000. The village of Nyack purchased the water works in 1897 by condemnation proceedings and after a series of experiments and studies in other directions decided upon a gravity sand filter for Hackensack creek water, most of the former supply having been drawn unpurified from the stream.

The filter consists of two beds each of 8,200 square feet area and a pure-water reservoir with a capacity of 44,000 gallons. It is wholly in excavation, with earth embankments to protect it from high water in the creek. The walls are concrete for 3 ft. 8 ins. above the bottom, thence a vitrified brick paving on a slope of 1½ to 1 for a vertical hight of 4 feet. The bottom is of concrete, the regulating and intake chambers are of brick, the division wall between the two beds is of concrete below the sand and of brick above. The filtering material is 3 feet of sand on top of 1 foot of gravel with 6-inch tile pipe for drains. Each bed has a main drain of tile pipe leading to the regulating chamber. The pure water well is of brick with a bottom of concrete. It is separate from the filter but connected with the regulating chamber by a 12-inch cast iron pipe.

The bottom 6 ins. of the filtering gravel is 1 to 3 ins. in greatest diameter; the next 3 ins. is ½ to 1 in.; the top 3 ins., 1 in. and less. In one-half the bed the gravel is washed gravel, in the other half the lower 9 ins. is crushed trap rock and hard field stone. On top of the gravel the sand is placed.

The water was wasted the first week the filter was put in operation. It was then pumped into the reservoirs, although still quite turbid. The turbidity disappeared in about three months. The rate of filtration is regulated by the pumps, which draw from the pure water well to supply the reservoirs. They run at a uniform rate for at least 9 hours a day. The maximum consumption is at the rate of 630,000 gallons a day, giving a maximum rate of filtration with one bed in use of 3,326,000 gallons per acre per day. This rate is never reached as both beds are used except when one is being cleaned, which has not occurred at time of maximum pumpage. The development of some springs is reducing the amount of filtered water required and the introduction of meters is reducing the consumption. The beds were finally completed in May, 1900.

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The cost of the filters, increased somewhat by an intermission in construction, was $29,091.

The Wright Demand System of Measuring Electricity.

The officials of the United Electric Light company at Springfield, Mass., expect to have the new system of measuring electricity known as the Wright demand system, installed and in operation by March 1. It will be necessary to keep the system working for a month in order to determine what rates can be made after that time. It is believed that the rate will be 18 cents for the first 1,000 Watt hours, with a secondary rate of 8 cents for each 1,000 Watt hours thereafter. This will be the primary rate for all consumers ranging from above 40 hours' use of monthly demand in winter to above 20 hours' monthly in summer. The rate will be still further reduced according to larger amounts used and the conditions governing the service. Under the present system the general rate is 23 cents per 1,000 Watt hours, with the following discount to consumers of 25,000 Watt hours, 20 per cent.; 50,000, 30 per cent.; 100,000, 35 per cent; 200,000, 45 per cent. Other larger discounts are given depending on the conditions under which the electricity is applied.

A Decision in Utah on Underground Water.

A decision was rendered at Salt Lake City, Utah, Jan. 28, by Judge Rolapp, in the case of the Herriman Irrigation company vs. George W. Keel et al. The action was to restrain the defendants in their mining operations through the Butterfield tunnel from interfering with the flow of water from the plaintiff company's springs. Judge Rolapp's decision was in favor of the defendant. In his opinion the flow from the tunnel is percolating and seepage water, and not from the Herriman Irrigation company's springs. He finds further that Keel and the other defendants have never taken more than their share of water, but he suggests that a commissioner be appointed to divide the waters at the headgate, the commissioner to have the same powers conferred by a former decree of the court.

State Highway Laws Do Not Apply to Kansas City Streets.

The court of appeals, at Kansas City, Mo., handed down an opinion Feb. 4th in the case of Margaret Kerney vs. the Barber Asphalt Paving company in which it held that the laws of the state regarding highways do not apply to the streets of Kansas City, because the enabling act providing for the formation of charter cities gives those cities exclusive control of streets and alleys.

While driving a buggy on the city's streets Mrs. Kerney met a big steam roller owned by the Barber company. Its clanking noises and escaping smoke and sparks frightened her horse, causing it to run away and throw her out, injuring her. She brought suit against the company and obtained a verdict for $1,250 under the state law requiring portable engines on a public highway to stop within 100 yards of an approaching team and remain still until the horses were past. The Barber company appealed the case, and the judgment of the lower court was reversed on the ground that there was no law requiring portable engines to stop for fear of frightening horses.

Olmsted Park, Boston.

The park commission of Boston has joined Leverett and Jamaica parks and given the name of Olmsted park to the entire area, in honor of Frederick Law Olmsted.

Prize for Plan for Reclaiming Newark Salt Meadows.

Alexander C. Chenoweth of New York City has been awarded the third prize for reclaiming the meadows within the limits of Newark, N. J. The plan is to extend a dyke along five miles of water front, and to divide the 3,000 acres back of the dike into four separate drainage sections. Surface drains will conduct the water to four pumping stations discharging into Newark bay. The November, 1900, issue of Municipal Engineering described the plans receiving the first and second prizes.

Gleanings from Reports of Municipal Officers.

In the annual report of the committee on streets and sewers of the common council of Plainfield, N. J., is a history by Joseph O. Osgood, C. E., of the processes of sewage purification by septic tanks and contact beds, which gives a very clear, condensed statement of their development. It is proposed to utilize the existing sewage purification beds, with an area of about two and one-fourth acres, which have not been very successful, for two septic tanks, each 50x100 feet, and with water six feet deep, and eight contact beds each 92x106 feet, with concrete walls and floors, filled four feet deep with stone one inch or less in diameter and one foot of coarse material. Sewage runs through two beds in succession by the double contact system. It is expected that this plant will prove sufficient for 900,000 gallons of sewage per day, and that the expense will be $1,500 a year. There is area enough remaining to quadruple the plant now planned when it becomes necessary.

The report of the trustees of the Piqua, O., water works states that the water supply was introduced for fire protection, sprinkling and boiler service and domestic use was a secondary consideration. This is still true to some extent. The receipts during the year ending May, 1, 1900, were $9,568.05, and the expenses of operation were $5,144.32.

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leaving a balance of $4,423.73. Of this amount $3,126.56 was spent for extensions and for driven wells to increase the supply of water. The total cost of the works to date is $119,931.30, but the city is deriving power from a hydraulic canal which cost $268,911.64 additional. No charge is made to the city for public uses. An estimate of the value of this service places it at $9,900 a year, which is probably a somewhat greater amount than would be paid a private company for the service; for example, six flush tanks for sewers are charged at $200 each, but fire hydrants are charged at $40 each. The original cost of the works, $56,896.84, was paid by the city, and some of the additions, which have nearly doubled the cost of the works, have also been paid by the city. The sum of $9,900 a year wipes out the interest and the indebtedness at quite a rapid rate. Considerable additions must be made at an early day, and the new supply will be more suitable for all purposes, including domestic water supply. W. B. Mitchell is secretary of the board.

The report of the board of water commissioners at Watertown, Wis., shows receipts $6,605.86. Of this amount $1,376.05 was spent in new construction and improvements, the remainder, except $170.01, being the cost of operation, repairs and maintenance. The city pays nothing for public uses, but it is supposed to maintain a hydrant fund which can be used to pay the bonds of the works as they become due. The works have cost $115,043.19. Of this amount $90,000 is represented by bonds of the water company from which the works were purchased, which fall due at the rate of $3,000 a year, and $10,000 by bonds issued by the city, of which $4,000 are yet outstanding. The coal bill is $1,535.94. A little over 35 per cent. of the taps for services, 384 in number, are metered and about the same proportion of the total consumption is metered. Three-fourths of the metered water is furnished to the railroads and about one-tenth to public buildings. The increase in number of meters during the year was about 25 per cent. Julius Fix is superintendent and William F. Voss is secretary.

Middletown, N. Y., is a city with a population of about 15,000, securing its water supply by gravity, with a little aid from pumps drawing from wells to reservoir in dry seasons. The water works have cost $421,304.93. A report was made in September, 1900, estimating the cost of desirable additions to the supply at $190,000. A mechanical filtration plant is under construction to improve the quality of the water, upon which about $13,000 has been expended to date of report. The cost of operating the filter plant will be from $2,000 to $3,000 a year. There are 2,026 taps, of which 129 are metered. The receipts in 1899 were $37,602.01. The operating and maintenance cost was $6,540.13. It was not necessary to run the pumps during the year. When they are run they cost $3,000 a year. Operating expenses have run as high as $11,000 a year. The cost of running filters must hereafter be added. The works paid nearly $20,000 on construction account, over $8,000 interest and $2,000 for bonds during the year. The city is charged nothing for public uses. An estimate of the saving to the city on this account makes it $10,610 a year. This is a rather low estimate, hydrants being charged at $40, flushing sewers at $100 a year, schools $150, etc. The meter rates are low, especially in large amounts, ranging from 15 cents per 100 cubic feet to 4 cents per 100 cubic feet. A discount of 25 per cent. is made to all meter users for payment of bills in 60 days, and to manufacturers the discount is 50 per cent. Notwithstanding the low rates it is apparent that the water taker, especially at flat rates, pays more than his shore of the city's expense. T. W. Davey is superintendent and James M. Hill secretary.

The report of the board of water commissioners of Norfolk, Va., shows receipts of $209,748.05 during the year ending June 30, of which $108,114.35 is from water rents, $70,841 is from sale of bonds and $13,752.83 from proceeds of water tax. The expenditures were $211,656.11, of which $99,278.88 was for operating expenses and maintenance, including $53,236.10 on filter plant, $50,538.73 for extensions and improvements, and $61,839 for interest and bond payments. A new mechanical filter plant was constructed in 1899 costing $109,515.96 and having a capacity of 8,000,000 gallons a day. The superintendent calls attention to the great waste of water and the advantages of the meter system in stopping it and so postponing the day when large additions must be made to supply and to filter plants. At the lowest meter rate, 10 cents per 1,000 gallons, the revenue from the water pumped should be $187,140, showing a loss of at least $79,026. The average consumption and waste is 111 gallons per capita. A full description of the filter plant is included in the report. A new 10,000,000 gallon pumping engine is needed. The average daily pumpage is 5,127,124 gallons. H. L. Smith is superintendent and Geo. W. Wright is chief engineer of the plant.

This report was referred by the select and common councils to the city engineer with the request that he reply to the questions, the estimated cost of relieving the present situation, the cost of installing meters, and his judgment as to the most effective and best solution of the matter. In a report dated Jan. 28., 1901, the city engineer, W. T. Brookes, gives an estimate of $169,154 for new supply main, $10,000 for new centrifugal pump and boilers for pumping to filters and $1,000 for repairs to supply pump, a total of $180,154, and adds

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that in a very short time a new service pumping engine, new boilers, addition to filters and new subsidence basin will be necessary at a cost of $78,000, making in all $258,154. For the second question he estimates 7,600 meters for ⅝-inch service pipes at $13.50 and 400 for ¾-inch pipes at $17.50, a total of $109,600, the expenditure of which will be distributed over a number of years. For the third question, after marshaling a large number of facts and opinions of experts, he pronounces judgment emphatically in favor of meters. The argument which he presents is practically unanswerable and can only be overcome by a prejudice so strong that it cannot be removed by the most direct appeal to the pocket-books of consumers and taxpayers.

New Publications.

Street Pavements and Paving Materials. A manual of city pavements, the methods and materials of their construction, for the use of students, engineers and city officials. By Geo. W. Tillson, M. Am. Soc. C. E., Asst. Engr. Department of Highways, Brooklyn, N. Y. Octavo, 544 pages, 60 figures, cloth $4. New York: John Wiley & Sons.

Mr. Tillson has made a very satisfactory effort to cover the field defined in the title of his book. A short history of the development of pavements is followed by a chapter on the kinds of stone from which pavements are made, including those used for broken stone in concrete. In the nature of the case this can not be given in sufficient detail to cover variety of local material, but it mentions the more important kinds of stone. A digest of the discussions upon the nature of asphalts and descriptions of the more prominent asphalts and asphaltic limestones and sandstones, and similar treatment of the clays and shales used for making paving brick give outlines for more detailed study of these materials. The chapter on cement and concrete is longer and will not be considered entirely satisfactory from a theoretical standpoint, but practically will be a safe guide if not always clear. The chapter on the theory of pavements is probably that upon which the author has expended most thought. It opens with a historical statement of the various materials that have been used for pavements and then discusses the relative weight of cheapness, durability, ease of cleaning, resistance to traffic, slipperiness, ease of maintenance, and favorableness to traffic in determining the kind of pavement which shall be chosen, and gives examples of methods of combining these elements for streets of various kinds. The effect of making openings in pavements is also discussed briefly. About 200 pages are filled with illustrated descriptions of methods of construction of various pavements, with statements of cost of actual work. There are chapters on cobble and stone block, asphalt, brick, wood and broken stone. While each engineer of experience will find some points in which he differs from the author, the chapters all give examples of good practice and present standards of good construction for the guidance of municipal officials, the effect of which is not marred by suggestions of cheaper methods of doing work. The chapters on brick and macadam are perhaps less satisfactory than the others. A valuable chapter is that discussing the reason for the various requirements of contractors made in the usual general specification. Full construction specifications for all the materials mentioned are also given, also methods of construction of street car tracks. The important questions of widths of roadways and sidewalks, grades, curbing, material for sidewalks, are discussed in sufficient length. There is also a short chapter on asphalt plants.

Proceedings of the Milwaukee Conference for Good City Government and Sixth Annual Meeting of the National Municipal League, held Sept. 19-21, 1900, at Milwaukee, Wis. Clinton Rogers Woodruff, Editor, 286 pp. cloth. Office of Secretary, Girard Building, Philadelphia.

The valuable papers and the discussions of them at the Milwaukee meeting are given in full in the volume. Time spent in study of them by all interested in good city government would be well spent. The new municipal program which has been under discussion by the society for some years received its full share of attention with papers on various phases of it by Joshua Stark, Charles Richardson and Samuel E. Sparling. Wm. Dudley Foulke took a prominent part in the discussions and there were papers by John F. Burke and Washington Gladden on the influences of public service corporations on city government and legislation. Uniform municipal accounting also received much attention with papers by M. N. Baker, James B. Cahoon and Harry B. Henderson. The League always prints a few more copies of the proceedings than are needed to supply its members and they can be obtained at a low rate from the secretary.

Personal Notes.

Martin Lutz has been appointed city engineer at Celina, O.

A. B. Tracy has been appointed city engineer at St. Albans, Vt.

A. B. Mader has been appointed city surveyor at Prescott, Ariz.

John B. Ansley has been elected city engineer at Americus, Ga.

C. J. Corcoran has been elected city clerk at Lawrence, Mass.

Hon. James H. Cisney, mayor of Warsaw, Ind., died Feb. 10 of pneumonia.

Major O. B. Gunn, C. E., Kansas City, Mo., died Feb. 18 of stomach trouble.

Dow R. Gwinn has resigned his office as superintendent of the Quincy Water Works,

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Quincy, Ill., to accept that of president and general manager of the Terre Haute Water Works company, Terre Haute, Ind.

L. B. Denison has been appointed chief engineer of the sewerage system at Delaware, Ohio.

John D. Merrill has been elected president of the common council at Cambridge, Mass.

George W. Howell, city engr. at Morristown, N. J., died at his home in that city Feb. 15.

Harold Fraser has been appointed superintendent of the gas and electric light works, Brockville, Ont.

Charles A. Sweet has been appointed city engineer at Syracuse, N. Y., to succeed Russell R. Stuart, resigned.

N. K. Connolly, engineer of the Jersey City Water Supply company, Jersey City, N. J., died Feb. 9, aged sixty years.

George H. Boughman has been appointed chief engineer of the surveyor's department of the city of Wilmington, Del.

D. R. Shirk has been appointed superintendent and engineer of the Elizabethtown Water company, Elizabethtown, Pa.

A. G. Carpenter, formerly county surveyor, has been appointed city engineer at Olathe, Kas., to succeed Fred A. Pickering, resigned.

William Gavin Taylor has been appointed city engineer at Medford, Mass. Mr. Taylor has been acting city engineer during the last year.

S. A. Mitchell has resigned his position as assistant city engineer at Kansas City, Mo., and will enter into private practice with offices in the New York Life building.

O. L. Nichols, principal assistant engineer of the new East River bridge, lectured before the Technical Society of Brooklyn Feb. 15 on "The New East River Bridge."

J. D. McKay has been re-elected president of the Iowa Falls Electric Light and Power company at Iowa Falls, Ia. W. H. Courtney was elected vice-president and F. E. Foster secreatry.

Palmer C. Ricketts, M. Am. Soc. C. E. and director of the Rensselaer Polytechnic Institute at Troy, N. Y., was elected president and trustee of the institute Feb. 19 to succeed Hon. J. H. Peck, resigned.

Ambrose Howard Carner, managing director of the New York & Bermudez Asphalt company, and V. M. Backus, representative of the Warner-Quinlan Asphalt company, Venezuela, have arrived in New York City.

George Matt has resigned as general manager and secretary of the Lancaster Electric Light company, and the Lancaster Gas, Light & Coke company, Lancaster, O., and is succeeded by his son, Edward Matt.

P. W. Henry, Assoc. M. Am. Soc. C. E., vice-president and general manager of the Barber Asphalt Paving company, delivered an address before the students of the Rensselaer Polytechnic Institute at Troy, N. Y., Feb. 15 on "A Sketch of the Asphalt Paving Industry."

Thomas Downs has resigned his position as mechanical engineer in charge of the water system of the city of Chicago, having accomplished the work assigned to him when appointed four years ago to organize and systematize the water works and various pumping stations. Mr. Downs will engage in private business.

A. Wilfred Zahm has resigned as secretary and general manager of the Manhattan Light, Heat and Power company at St. Paul, Minn., to become general manager of the Light, Heat, Transit and Public Service company at St. Cloud, Minn.

Mayors have been elected in the following cities and towns: Jacob Phinizy, Augusta, Ga.; Dr. T. B. Bullard, Palmetto, Ga.; W. J. Outlaw, Pratt City, Ala.; I. P. Delmas, Scranton, Miss.; R. S. Adams, Oxford, Miss.; M. M. George, re-elected, Lithonia, Ga.; Nathan Emanual, Brunswick, Ga.; F. M. Weed, Ocean Springs, Miss.; Grant Graham, Piedmont, W. Va.; Dr. John E. Toole, Bainbridge, Ga.; R. L. Moye, re-elected, Cuthbert, Ga.; William C. Burgess, Auburn, N. Y.; C. W. Rich, Hattiesburg, Miss.; J. W. Strickland, Concord, Ga.; L. D. Borders, Brookville, Tenn.; Edgar B. Stewart, Morgantown, W. Va.

SELECTIONS FROM THE PRESS.

Street Lighting.

The problem of the lighting of our streets in the best possible manner is one that is deserving of more serious attention than it generally receives. The numerous recent improvements both in sources of light and diffusing globes enable us to obtain brilliant street lighting at even less cost than the dingy lighting of twenty years ago. The public has a hazy notion that, by using the electric arc, far more light is obtained than when gas lamps are used, at no extra cost. When they find out from the corporation account that street lighting by electricity is more expensive, they begin to think that they must have been mistaken, forgetting that in this case the extra cost is due to the far higher standard of lighting demanded. The choice of injudicious globes which cut off 40 or 50 per cent. of the total light generated is often also responsible for the increased expense. The financial aspect we shall not consider in this paper, contenting ourselves with the problem of how best to illuminate our streets. In practice, of course, each street has to be considered on its own merits, but there are a few general considerations which ought always to be borne in mind.

One of the first points that has to be considered is whether the horizontal illumination—that is, the illumination of the ground—or the vertical illumination—that is, the illumination of passers-by and vehicles—is the more important. In the early days of arc lamp lighting the securing of a uniform

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horizontal illumination was what was aimed at. This was approximately obtained by placing powerful arc lamps at great hights from the ground. As an ordinary arc lamp gives out very little light vertically downward, and nearly all its light between angles of 20 degrees and 70 degrees with the vertical it is specially suitable for obtaining a uniform ground illumination. The great drawback to this method of lighting was the absorption of the light by the atmosphere, the slightest haze or fog absorbing most of the rays. The importance of this effect was not realized at first, but practical experience soon proved the necessity of lowering the lamps. This was a fatal objection to the various schemes for lighting towns by a series of lofty lighthouses which have from time to time been proposed.

Incandescent gas burners give out their light in quite a different way to arc lamps. Most of their light is given out horizontally, the candle power at 45 degrees being only one-third of what it is horizontally. Hence the vertical illumination produced by these burners is very good when they are not placed too high up. The perspective effect produced by a row of Welsbach lamps is distinctly good, as they are visible a long way off. With alternating current arc lamps, with the usual large shades fixed over them, this perspective effect is almost entirely lost, which greatly detracts from their appearance in a long street. Until, however, stronger mantles are invented, incandescent gas lamps are unsuitable for street lighting. After three months' experience at Leamington, they were discontinued, owing to the number of mantles broken by the vibrations caused by the traffic. In what follows we shall therefore confine our remarks to street lighting by arc lamps, as the electric arc is so well adapted for street lighting that there is no doubt that it will soon be more widely used than any other agent.

In practical work with arc lamps it is usual to plan the lighting so that the ground illumination will always be above a certain minimum, and in this case the vertical illumination is generally found to be sufficient. In many streets both in this country and abroad the arc lamps are arranged zigzag alternately on both sides of the street. This is an economical way, and, if the streets are narrow, it is fairly effective. Another favorite system in this country is to place arc lamps in refuges down the center of the street, and in wide, busy thoroughfares this is a good way, although we lose a considerable amount of the reflecting power of the walls of the houses, which is often a great help. A very effective way is used in Fifth-ave., New York, which is extremely well lighted. In addition to rows of arc lamps down each side of the street exactly opposite one another, there is a row down the center (sic) each lamp in this row being at the center of the rectangle formed by four neighboring side lamps.

Span wires attached to houses on each side of the street are sometimes used for suspending arc lamps, and this method is attracting a good deal of attention at present. In the principal streets of Milan the arc lamps are hung in this way from span wires at distances of sixty yards. Although these wires, as well as the overhead wires for the electric tramway, are unsightly in the daytime, yet at night the effect is excellent. It is also a decided advantage to get rid of lamp posts from the pavements.

For physiological reasons, if we have a brilliant lamp care must be taken that the light is well diffused. If we have a dazzling source of light, then the pupil of the eye partially closes, and so cuts off some of the rays that would have reached the retina had the light been better diffused, and as the effect of the illumination is proportional not only to the intensity of the rays that reach the retina but also to their number, it follows that increasing the intensity of the light may actually diminish the illuminating effect. This difficulty is always experienced when the electric arc is used, and hence many attempts have been made to get over it. The usual way of reducing the dazzling effect is to surround the arc with a good distributing globe. When opal globes are used the light is soft and diffused, but the absorption is considerable. It is a wasteful method to generate a light of 1,500-candle power, and then reduce it to 1,000 by using a semi-opaque globe; hence the attention of many engineers is directed toward inventing a globe which will not only refract the light in the best possible manner, but will diffuse it so thoroughly that the eye will not be dazzled by looking at it.

Mr. A. P. Trotter, the well-known electrician, invented some fourteen years ago his dioptric lantern, which had ten panes of glass covered with prismatic corrugations, the angles of which had all been carefully calculated so as to produce the best possible distributing effect. Unfortunately not only was it expensive, but it had a clumsy appearance, and so it was never extensively used. Yet the idea was good, and he may fairly claim to have been the first to prove how important it is to accurately design globes according to the laws of geometrical optics.

The Fredureau and Holophane globes have been designed and made in a very similar way to that employed by Mr. Trotter, but they are much more elegant than his, and are made in all shapes and sizes. The Holophane globes, about which so much has been heard lately, absorb very

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little light, and yet the diffusion is almost perfect. Those used for street arc lamps are spherical in shape with horizontal prismatic ribs on the exterior, and vertical flutings on the inside, so that the light is thoroughly diffused in the interior, and then suitably distributed by the external prismatic circles. In Paris, on the boulevards between the Rue Hauteville and the Porte St. Denis, several of the arc lamps have these globes. The general aesthetic effect is good, and the mean illumination has been increased by their use. The practical objections to them are that they are divided into two parts, which need care in fixing together, and that it is difficult to keep them clean; for, like all prismatic globes, they are very apt to catch the dirt, and so need plenty of washing and scrubbing. This materially adds to their expense, for it is obvious that one trimmer could not attend to many of these lamps in a day.

The Fredureau globe is like the Holophane, except that it has no internal flutings, and hence the diffusion is not quite so good, the inside source of light appearing as a bright vertical band from the outside. Although these globes are dearer than ordinary ones, yet, as they enable us to save current, they may prove more economical in actual use.

Street lighting with glow lamps has not proved sucecssful on any large scale, and considering how much cheaper arc lighting is this not to be wondered at. What we have said hitherto applies to continuous current arc lamps. In the continuous current arc nearly all the light is emitted downward, the maximum intensity being 45 degrees with the vertical. With the alternating current arc as much light is sent upward as downward, so that it is equivalent to two small continuous current arcs, one being inverted. Up to the present time no thoroughly satisfactory way of utilizing the light of an alternating current arc has been found. The ordinary way of using large reflectors is objectionable, as at some distance off they shade far too much of the light coming from the lamp. Mr. S. Z. de Ferranti gets over the difficulty by converting the alternating current into a rectified one or current pulsating always in one direction, and using ordinary continuous current arc lamps. This method is a very popular one in this country. M. Blondel proposes to convert the alternating current into continuous by means of an alternating current motor driving a continuous current dynamo, but this way would be more expensive than the last.

Recently in America a lamp has been invented in which the carbons are placed parallel to one another, and the alternating arc kept at their lower ends by means of electro-magnetic repulsion. If this lamp works well it ought to greatly simplify the problem of how best to utilize the light of the alternating arc. It is still a vexed question with electricians as to whether the alternating current arc is less efficient than the continuous current arc or not. The general opinion seems to be that it is less efficient.

There is no doubt that brilliant sources of light and beautiful globes are desired by the public, and if globes like the Holophane prove a commercial success, a great impetus will be given to the efficient lighting of our streets. Rows of dingy lamp posts at present obstructing the pavements of the main streets of many towns could be removed and the streets effectively lighted by a few arc lamps in elegant globes, judiciously placed, without unduly burdening the rate-payer.—London Builder.

The Protective Power of Paints.

In a paper read some time ago before the Newcastle section of the Society of Chemical Industry, Mr. Henry Smith, F. I. C., described a series of very interesting experiments upon the comparative protective powers of different paints as applied to ironwork. Three series of experiments were made. In the first series a method originating with Mr. Max Toltze was employed. A number of iron dishes, 5 inches across and about ½ inch deep were cleaned and carefully painted with two coats of the paint to be tested. These dishes were then filled with water, which was allowed to completely evaporate at the ordinary temperature of the laboratory, after which the dish was again filled up, this operation being repeated six times in the course of six months over which the experiments extended. The paints used were prepared by grinding the pigments with linseed oil on granite rollers to a stiff paste, which was then thinned with best quality boiled linseed oil—itself capable of drying in seven hours to a hard film when painted on to a glass plate. Thus tested, the only paints which remained practically unaffected were red lead or orange lead paints, some of which, however, such as the "vermilionette" and the scarlet red paints, contained also a certain proportion of aniline colors; whilst two of the red-lead paints contained, in the one case 45 per cent. and in the other 66 per cent. of barytes. All the other dishes were more or less rusted, the order of merit of the better paints being as follows: 1. Zinc white. 2. Equal parts zinc white and barytes. 3. Zinc white, 3 parts; barytes, 7 parts. 4. Lithopone (a mixture of zinc sulphide, zinc oxide, and barium sulphate). 5. Pure white lead. 6. White lead, 5.37 parts; barytes, 4.03 parts. 7. White lead, 5.05 parts; barytes, 4.21 parts. All the other paints, 36 in number, proved very inefficient, the first dish

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to show signs of rust being painted simply with linseed oil.

In the second series of experiments a number of painted iron plates were exposed to the weather for a twelvemonth, and with the single exception of the plate painted simply with linseed oil, all withstood the test remarkably well. In the third series of tests, strips of iron were painted, and when the second coat was quite dry these strips were placed in wide-mouthed glass bottles, which were then nearly filled with water and allowed to stand. The bottles were not closed, but the contents were protected from dirt by standing them under a shelf, there being about one-half inch of space between the top of the bottles and the underside of this shelf. The bottles were left untouched for three months. Some of the plates were sensibly affected within seven days; but those which successfully withstood the shallow-dish test also resisted this one most successfully. The fact that paints containing such large proportions of barytes, as some of the lead paints noted above, gave such excellent results is of much interest, as it goes to show that this material can hardly be considered as a mere adulterant. In fact, one paint made up only of barytes and linseed oil gave better results than an oxide or iron paint. Mr. Smith refers with approval to the methods adopted in painting the Forth bridge. All plates and bars for that structure were cleaned with steel scrapers and wire brushes and then coated with hot linseed oil. As soon as possible after erection they received two coats of red-lead paint, which were subsequently followed by two coats of iron oxide. The life of the paint on the upper portions exposed to the weather is found to be about three years, but it must be added that the paint is then still in good condition, and on less important bridges would by many engineers be allowed to pass for several years longer. Experience shows, however, that in such cases the metal is liable to be deeply pitted. The paint inside the tubes of the Forth bridge is as perfect as when first applied twelve years ago. The parts of the bridge most subject to rust are near the water, where the underside of the girders get sprayed with salt. The rusting commences on the rivet heads and the edges of the plates. These portions of the bridge are cleaned and repainted every year. The work is in charge of Mr. A. Hunter, who has supplied Mr. Smith with the above particulars.—American Gas Journal.

The Temperature for Burning Portland Cement.

The value of determinations based on laboratory experiments of the stability of materials, and of the treatment with heat for obtaining good Portland cement has been frequently doubted, with the idea that such experiments could not be thoroughly determinative because in the laboratory the masses are burnt under conditions which do not wholly correspond to those of the industrial stock productions. For even when the kiln used for this purpose in the laboratory is an exact model of the industrial kiln, it accomplishes the cooling off of the burnt mass too quickly. If, however, to avoid this, one keeps the fire going longer the burnt mass runs the risk of being vitiated by the rest of the combustibles which are consumed in much greater quantity. Therefore, R. Feret, chief of the laboratory of bridges and causeways at Boulogne-sur-Mer discerns in the law developed by B. Spencer and W. Newbury, of the chemical composition of cement, a weak point, namely, that the two investigators always used for their experiments only a limited quantity of material, about 300 g. In the conclusion of his discussion, however (in the Bulletin de la Societe d'Encouragement, Paris, 1898, p. 867), in the recognition that a large industrial kiln is never used for demonstration in experiments that appear absolutely necessary, he formulates as follows the resquirements for an experimental kiln for the laboratory.

1. It must have a capacity for burning 220 lb. of cement-mass.

2. Its temperature must be controllable within intervals of about 100 degrees, and capable of being raised at least 1,000 degrees and sustained there at will.

3. The heat of the kiln must be at will interchangeably oxidizing or reducing.

4. The burden must have sufficient protection from the influence of the kiln-walls and the fuel-residue. That he has erred greatly as to the hight of the requisite maximum temperature, Feret soon acknowledges and in a postcript (p. 1114) places the minimum at 1,500 degrees. However, he has not contented himself with this correction, but has also fixed nicely the minimum temperature required for burning cement. Thereon he reported in the aforesaid bulletin on page 121, for 1899.

In determining the temperature, he made use of "hard steel", whose composition he unfortunately failed to give. In one of the shaft-furnaces in operation a few years ago in the cement works mentioned, steel bars of various thicknesses and 31.5 in. long were inserted five or six times. Of these no traces were ever found on clearing out the furnace. Of a 31.5-in. steel bar with an .8x.8-in. section, only a pointed end piece with significant signs of the melting remained. Now two steel bars 6 ft. 6 in. long were set up in different places in a Hoffmann kiln, so that they stood erect in the midst of cement bricks, and at a certain distance from the stoke-holes for the coal. Only half the length of each of these bars remained after the burning. Of one bar the lower half remained. It was

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straight, but very much swollen, rounded, porous, and very brittle, and looked almost like a piece of lignite. With the exception of the uninjured part, about .1 of an inch thick, along the axis of the bar, the mass was black and shining, and, on chemical analysis, proved to be magnetic iron (Fe 3 O 4) which had evidently arisen from the decomposition of the red-hot iron with water-vapor swept along by the draft of the furnace gas.

The other steel bar was bent in several places by the falling in of the surrounding mass of cement; and two pieces of it were found again, of which the longer one had belonged to its upper part and the shorter one to its base. These residues were less swollen than that of the first bar, but corroded on the surfaces. The ends of it extending towards the missing middle part tapered to points, and thereby showed that the piece of bar missing from between them had been melted away. The pretty homogeneous but very heavy mass of cement clinkers (of 3.35 density instead of the normal 3.20) found in the neighborhood of this melted portion contained, moreover, 17.5 per cent of iron oxide; whereas usually the cement produced at the same factory contained only about 2.5 per cent.

An essential condition for the examination, however, is that one makes sure in both cases that the mass of cement clinker about the remnants of the bars were burnt insufficiently before, while those masses where the steel was melted could pass for well burnt. Hence one may conclude that the necessary temperature for burning Portland cement is higher than the melting-point of hard steel and corresponds pretty nearly to that of wrought iron. This, if one takes 1,065 degrees as the melting-point of gold, on the basis of the latest discoveries, will amount to about 1,600 degrees. Therefore, according to Feret's judgment, a good experimental kiln for performing experiments in the manufacture of cement should allow the heat to rise easily to at least 1,800 degrees, so that one can burn pure pastes in it which are free from the fluxes so often met with in the cement business.—Translated from the Thonindustrie-Zeitung for Brick.

On the foregoing experiment, the Thonindustrie-Zeitung comments as follows: "We consider it an utter mistake to try to determine the temperature in cement kilns by laying in steel bars; for every technist should know that steel does not remain steel after it is redhot, either in the oxidizing or the reducing atmosphere. By the change which the steel undergoes its melting-point is also changed. The circumstance, in the experiment cited, that the steel is no longer found is traceable to the fact that, through the reducing atmosphere which most of the time, if not always, reigns in the cement kiln, the steel is changed, by the reception of carbon, to cast iron, which, as is well known, is easily fusible. The experiments made by us to determine the burning temperature for cement gave no higher temperatures than Seger cone 15. We gladly place chills and cones at disposal in case they will fix the temperature in your kilns. Furthermore be it known in this connection that many years ago Herr Director Meyer, in Mahlstatt, made experiments in burning in the gas-furnace of which the Seger-furnace serves as a prototype."

MACHINERY AND TRADE.

Tar Macadam.

A little pamphlet on Tar Macadam Roads has been issued by the National Coal Tar company, No. 100 Williams-st., New York, giving specifications for the pavement, some statement of its utility, and of its success in Hamilton, Ont., and in Providence, R. I., where tar has been used to some extent in the top layers of macadam pavement for several years.

Recent Inventions.

(Reported especially for MUNICIPAL ENGINEERING by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for ten cents.

667,445. Feb. 5, 1901. Garbage Furnace or Crematory. Eugene J. Little, Daniel C. Shaw and George H. Breymann, Toledo, Ohio. The refuse is burned upon an elongated grating above which is an arch having trap doors therein, said arch forming the floor of a drying chamber. Two furnaces are formed at one end of the elongated grating, one of the said furnaces discharging over the grate, and the other beneath the grate, and the heated gases from both furnaces pass back through the drying chamber. The material, when dry, is discharged through the trap doors upon the elongated grate.

667,871. Feb. 12, 1901. Fireproof Building Structure. Julian O. Ellinger, Baltimore, Md. A peculiar arrangement of interlaced rods forming the support for concrete partitions or floors.

668,127. Feb. 12, 1901. Water Filter. George F. Hodkinson, Chicago, Ill. A gutter is formed at each side of the filter bed and connecting passages formed between the gutters and bed with a peculiar arrangement of gates for the passages. Mounted above the bed is a traveling agitating means for loosening the material of the bed.

668,232. Feb. 19, 1901. Bridge. Joseph B. Strauss, Chicago, Ill. The counterbalance

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of the span is so arranged as to be lowered into the water as the span rises, the resultant effect of the counterbalance being thus varied in accordance with the position of the span.

668,366. Feb. 19, 1901. Fireproof partition. William. N. Wight, New York, N. Y. A clamp for partitions consisting of a pair of flexible frames of metal, one lying upon each side of the partition, and a metallic tie conecting the frames and lying between the blocks of which the partition is formed.

668,530. Feb. 19, 1901. Fireproof arch. Samuel Lord, New York. A peculiar interlocking tile having intermediate partitions of such form that the tile may be broken at predetermined points to vary the length of the arch formed by one or more of the tiles.

668,610. Feb. 19, 1901. Automatic drawbridge gate. Victor Johnson, Aurora, Ill. A pair of flexible gates automatically drawn together across the roadway by the movement of the bridge span.

Trade Notes.

ASPHALT.

The Minnesota Asphalt Block company has opened up offices at the Endicott Arcade, St. Paul, Minn., with George M. Cushing as manager. A $50,000 plant will probably be built this spring.

The construction of an asphalt plant, at a cost of $8,000, for the repair of asphalt pavements, is recommended by James H. Meagher, commissioner of public works at Syracuse, N. Y.

CEMENT.

The Kinderhook Portland Cement company, Indianapolis, Ind., has been incorporated to manufacture brick, cement and tiling. Capital stock $2,500, with an authorized capital stock of $900,000. The incorporators are C. A. Kenyon, F. A. Joss and H. G. Branden.

The Nazareth Cement company, Nazareth, Pa., contemplates increasing its plant.

The Lupton Portland Cement company contemplates erecting a $400,000 plant in Lupton, Mich., of 1,200 bbls. daily capacity. The company was incorporated in January under the laws of the state of New Jersey with a capital of $1,250,000. The officers are: President, Geo. T. Stanley, Lupton; vice-president and treasurer, Edward A. Worthington, Chicago; secretary, Walter Higgs, Chicago; assistant secretary, Wm. C. Edgar, Chicago.

The German Alsen Portland Cement company of Hamburg, in addition to its property at West Camp on the Hudson, New York, is reported to have purchased three farms containing valuable and accessible deposits of cement rock and limestone in the Nazareth, Pa., district, the latest being the Charles Mann property, near Nazareth.

The National Portland Cement company, Ltd., has been incorporated at Toronto, Canada, for the purpose of developing the marl deposits near Owen Sound. The directors are: Wm. F. Cowhorn, Jackson, Mich.; P. W. Stanhope, Toronto; Wm. Pinkerton, Toronto; Albert Carman, Stratford, Canada; R. W. McWilliams, Owen Sound.

A tract of land has been purchased in Georgia by Homer W. Cummings, Uriah Cummings and Judge Blydenburg of Stamford, Conn. The land contains fine cement rock and a plant will be erected. A company has been organized and is known as the Chickamauga Cement company.

The Pyramid Cement company, Detroit, Mich., has been incorporated.

BRICK.

The Poston Brick company has been organized at Crawfordsville, Ind., with $50,000 capital. I. C. Elston is president, and Fred Hoffman secretary and treasurer. The company will manufacture paving brick and a patented block.

The stockholders of the old Utica Paving company, which was recently merged into the asphalt combine, will form a new paving brick company and will use vitrified brick instead of asphalt, according to press reports.

George S. Boswell is interested in the company which has been organized at Coffeyville, Kas., to build a vitrified brick plant.

The Brooklyn Brick and Sewer Pipe company of Brooklyn, N. Y., has been incorporated by George D. Beattys, C. Fred Johnson and H. L. Fordham.

MISCELLANEOUS.

A central heating station for three hundred houses is being erected at Washington Court House, O., by the Central Station Heating company of Cincinnati, O. The boiler being erected for this plant is believed to be the largest ever built.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Detroit, Mich.—Corporation Counsel Tarsney began suit Feb. 13th to recover from the Detroit railway the sum of $23,000 for paving between the tracks when the road was being built.

New Orleans, La.—About 22,000 sq. yds. of Schillinger pavement and 4,500 cu. yds. of concrete between the tracks of several electric car companies on Canal-st., is being constructed by John McCoy of this city.

CONTEMPLATED WORK.

Iola, Kas.—Paving is contemplated.

Hamilton, O.—Macadam paving is favored for Dayton-st.

Macon, Ga.—Asphalt paving is recommended by the street committee.

Owatonna, Minn.—The question of street paving is being considered.

Hancock, Mich.—Asphalt paving is contemplated for Quincy-st. Village board.

Lafayette, Ala.—This town proposes to improve its streets this year.

West Duluth, Minn.—A petition is being circulated for paving Central-ave.

Athens, Ga.—The macadamizing of Milledge-ave. is contemplated this summer.

Chicago, Ill.—The transformation of Lake-ave. into a boulevard is contemplated.

Bridgeport, Conn.—The purchase of a new road roller is contemplated by the council.

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Atlanta, Ga.—Capitol-ave., between E. Fair and Bars-sts., will be paved with asphalt.

Buffalo, N. Y.—Morgan-st., between Niagara and Genesee-sts., will be paved with asphalt.

Tiffin, O.—Plans have been submitted for paving a portion of Genesee-ave. and Hancock-st.

Patchogue (L. I.), N. Y.—The question of building a short road will be voted on in March.

Dover, N. H.—The sum of $17,000 has been appropriated for highways, and $2,000 for sidewalks.

Montgomery, Ala.—A bill has been passed in the legislature authorizing the issue of bonds for paving.

Milford, Mass.—The question of paving Main-st. is being considered. M. E. Nelligan, supt. sts.

East Orange, N. J.—Ordinances have been passed for the improvement of 1,700 ft. of Tremont-ave.

West Hoboken, N. J.—An ordinance has been passed for improving Newkirk-st. Chas. Dietz, chmn. com.

Akron, O.—A resolution has been passed to pave Grant-st., from Exchange to South, with brick or asphalt.

Portsmouth, O.—(Special)—W. H. W. Jenkins says a petition is being circulated for paving Findley-st. with brick.

Owatonna, Minn.—The estimated cost of the proposed brick or asphalt paving on Cedar-st. is $1.65 a sq. yd.

Lima, O.—Paving has been recommended for portions of W. High, Cole and Buckeye-sts. and Bruce and Rice-aves.

Pontiac, Ill.—About 30,000 sq. yds. of brick paving will be constructed this summer. P. C. Knight, engr.

Pittsfield, Mass.—Plans and estimates are being made for paving West and North-sts. A. A. Forbes, engr. B. P. W.

Woodbury, N. J.—Plans for improving Delaware and German-sts. have been approved by State Commissioner Budd.

Ft. Dodge, Ia.—Paving is contemplated for Sixth, Seventh, Eighth and Ninth-sts., from Central-ave. to First-ave. N.

Baltimore, Md.—The county commissioners contemplate the purchase of a stone crushing plant for the Fourth district.

Barberton, O.—The city engineer was directed, Feb. 11, to prepare plans and specifications for paving Second-st. with brick.

West Bay City, Mich.—A large amount of asphalt paving is contemplated for this spring, according to the local press reports.

Plainfield, N. J.—The paving of Prospect-ave., from Park to Woodland-aves., 100 ft. wide and 1 mile long, is contemplated.

Sumter, S. C.—Bids are desired for furnishing and laying 10,000 to 20,000 square yards of macadam roadway. C. M. Hurst, jr., city clerk.

Waco, Texas—Asphalt or vitrified brick paving is contemplated for Austin-ave., and the cross streets from Third to Eighth.

Eau Claire, Wis.—Ordinances have been adopted providing for brick paving in Eau Claire, Gibson and Barrow-sts., and Grand-ave.

Davenport, Ia.—(Special)—F. Heinz, mayor, says bids will be asked in the next sixty or ninety days for about twenty-five blocks of brick paving.

Cohoes, N. Y.—City Engineer Hayes has been directed to prepare plans and specifications for paving Newcome and Short Main-sts.

Champaign, Ill.—Plans for the proposed paving in Chestnut-st., from Main-st. to University-ave., are being made by City Engineer Tarrant.

New Haven, Conn.—The board of aldermen have decided to pave Temple, Elm and Olive-sts. and Howard-ave. with brick. C. W. Kelly, city engineer.

Albany, N. Y.—The question of resurfacing the block pavement on S. Pearl-st., to Gansevoort-st., with asphalt, is being considered.

New Orleans, La.—New specifications will be prepared by the city engineer for paving Jefferson-st., from Charles to Decatur, with asphalt.

Cambridge, Mass.—About 9,000 square yards of brick pavement will be constructed on Massachusetts-ave. by day labor. C. A. Brown, superintendent of streets.

Macomb, Ill.—(Special)—City Engineer Holmes says that bids may be asked about May 1, for 24,000 square yards of double course brick paving.

St. Louis, Mo.—The city council passed twenty ordinances Feb. 8, for reconstructing streets in the down town district. Robert E. McMath, prest. B. P. I.

San Francisco, Cal.—Asphalt paving on 6-inch concrete has been recommended by the board of public works for Pine-st., from Sansome to Battery.

Spartanburg, S. C.—This city voted $50,000 for street paving, which work will begin as soon as an engineer can be engaged and plans prepared.

Aurora, Ill.—A petition is being circulated asking for asphalt paving with combination cement curb and gutter on Fox-st., from La Salle to State.

Rock Island, Ill.—The property-owners on Twenty-first-st. have petitioned for brick paving. The council was originally asked to pave the street with asphalt.

Toronto, O.—Asphalt paving is recommended for Metcalf-st., and brick paving for Huron and Lombard-sts., in the annual report of the city engineer.

Utica, N. Y.—Resolutions have been introduced providing for paving Roberts, Cornelia, Seneca, State, Washington and York-sts., and Lincoln-ave.

Peoria, Ill.—Plans are being discussed, according to local press reports, which involve a system of paving on the West Bluff which will include fifty-four blocks.

Rochester, N. Y.—Mayor Carnahan will veto the ordinance providing for asphalt paving on Julia-st., and approve one for macadam, according to press reports.

Chelsea, Mass.—An ordinance has been passed appropriating $10,000 for paving Washington-ave. with brick, and $3,500 for the purchase of a road roller.

Birmingham, Ala.—An ordinance has been passed to pave the walks on portions of Lawn-st. and Alta-ave. with brick, with 6-inch granite curbing. W. M. Drennen, mayor.

Newport, Ky. (Special)—W. L. Glazier, supt. pub. wks., says 5,000 lin. ft. of macadam paving, averaging 40 ft. in width, with cement curb and gutter, is contemplated.

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Lawrence, Kas.—Resolutions are pending for paving Winthrop-st., from Mississippi to Massachusetts, and Pinckney-st., from Indiana to Massachusetts-ave.

Bay City, Mich.—The city engineer was directed, Feb. 11, to prepare estimates for the proposed brick and asphalt paving on Henry, Midland and Washington-sts. Mayor Lind.

Springfield, O.—A resolution has been adopted to pave Columbia-st., from Fountain-ave. to Limestone-st., with vitrified paving brick or block. R. N. Lantz, cy clk.

Syracuse, N. Y.—Plans and specifications have been approved for paving portions of Gifford to Jefferson. W. Fayette, Canal, Pearl, Harrison, Walton and other streets and avenues.

Cohoes, N. Y.—The city engineer has been directed to prepare plans for paving Broadway, Johnston and Younglove-aves., and Grant, Saratoga, Ontario, Newark, Lancaster, George, Schuyler and Seneca-sts.

St. Paul, Minn.—The board of public works has vetoed the resolution for paving Rice-st., from College-ave. to Front-st., with brick, and has passed an ordinance for asphalt paving for the street.

Pawtucket, R. I.—Granite block paving on a concrete foundation is recommended for Pawtucket-ave., in the annual report of the board of public works. Wm. A. Barclay, com. B. P. W.; Geo. A. Carpenter, cy. engr.

Michigan City, Ind.—(Special)—H. M. Miles, cy. engr., has been instructed to prepare plans and specifications for 35,000 sq. yds. of vitrified brick paving on Second, Market, W. Boston, S. Franklin and Michigan-sts.

Indianapolis, Ind.—The street improvements planned for this year include portions of 35 streets. The property-owners in Meridian-st., north of Fall creek, have petitioned for asphalt paving instead of wooden block as proposed.

Seattle, Wash.—The board of public works has approved estimates for brick paving on Jackson-st., Yesler-way, Third and First-aves. S., at a cost of $102,000 and proposed improvement of Madison-st., at $38,580. Cy. Engr. Thomson.

Buffalo, N. Y.—The residents on East-st., between Hertle-ave. and Paris-st., have petitioned for paving. The board of public works has decided upon amendments to the asphalt paving specfications cutting the guarantee term down to ten years instead of fifteen years.

Norwich, N. Y.—Petitions have been filed with the trustees asking for macadam paving on Silver-st., between E. Main and Rexford, and Broad-st., between Pleasant and Henry and American lane and Division-sts., and for brick for the business portion of Broad-st., between Henry-st. and American lane.

Petaluma, Cal.—(Special)—N. S. Frost, cy, engr., says that the board of trustees has passed resolutions for 2,000 lin. ft. of macadam paving on Western-ave., 600 lin. ft. of grading in Howard-st., 160 lin. ft. of graveling and macadam paving in Kentucky-st., and 2,100 lin. ft. of grading, curbing, guttering and macadam paving on Main-st.

Detroit, Mich.—The board of works estimates that $1,215,005 will be needed this year for paving and repaving, an increase of $312,928 over last year. Asphalt paving is desired for a number of suburban streets, including Cass, Garfield, John R. and Willis-sts., and brick is proposed for Amsterdam, Bates, Dix, Fort, Farmer, Plum, Russell, Warren and other streets.

Los Angeles, Cal.—Specifications are being prepared by City Engineer Stafford for paving that will admit of the use of home product. The general specifications as they are at present call for the use of "natural" California asphalt, and only one company can bid under these provisions, as it controls all the mines that produce that material. The new specifications will remove the restriction upon free competition.

CONTRACTS TO BE LET.

Marion, Ia.—Sealed bids are asked until March 4 for macadam paving on Seventh-ave. R. Richmond, cy. clk.

North Baltimore, O.—Bids are asked until March 4 for paving Main-st. with brick. J. Radebaugh, vil. clk.

Greenville, O.—Bids are asked until March 18 for block asphalt paving on Washington-ave. C. E. Caldenood, cy. clk.

Riverside, N. J.—Bids are asked until March 11 for macadamizing about four miles of streets. J. H. Norton, boro. clk.

Denison, Ia.—Bids are asked until March 4 for public roads in East Boyer township during 1901. A. C. Lochmiller, clk. bd.

Rome, N. Y.—Bids are asked until March 12 for brick or asphalt paving on N. Washington, N. George and Dominick-sts. G. E. Schillner, cy. engr.

Bedford, Ind.—Sealed bids are asked until March 4 for building gravel or macadam roads in Shawswick township. John M. Gainey, co. audt.

Collinwood, O.—Sealed bids will be received until March 11 for draining, grading and slagging E. Collamer-st. L. A. Wilson, vil. clk.

Cincinnati, O.—Sealed bids are asked until March 6 for paving McKean alley, from Baymiller-st. to Harold alley, with brick. Robt. Allison, pres. B. P. S.

Jacksonville, Fla.—Sealed proposals are asked until March 28 for 13,195 yds. of vitrified brick paving on portions of six streets. Philip Priolean, cy. engr.

Cincinnati, O.—Sealed bids are asked until March 2 for improving Summit-ave., from Edgewood-ave. to Reading road, Springfield township. Eugene L. Lewis, co. audt.

Alexandria, La.—The bids received Feb. 18 for brick paving on Second-st. were rejected and new bids will be received about March 10. Board of Improv. Comrs.

Annapolis, Md.—Sealed bids are asked until March 8 for paving Maine-st. with vitrified paving brick and asphalt block. H. M. Redd, cy. engr.; R. H. Lansing, Jr., cy. clk.

Marinette, Wis.—Sealed bids are asked until March 5 for about 3,785 sq. yds. of nine-inch macadam paving, 2,000 lin. ft. stone curbing and 1,300 cu. yds. excavation. A. L. Hillis, cy. engr.

Marion, O.—Sealed bids are asked until March 16 for paving as follows: Greenwood-ave., 6,805 sq. yds. brick or block paving; 1,960 cu. yds. grading; 6,805 sq. yds. Portland cement or patent ground filler. N. Prospect-st., 6,210 sq. yds. brick, block or

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sheet asphalt paving; 6,210 sq. yds. patent grout or Portland cement filler. Jas. J. Beatty, cy. clk.

Leavenworth, Kas.—(Special)—Sealed bids are asked until March 4 for 23,000 sq. yds. of vitrified paving brick on 6-in. concrete base on Tennessee-st., from Henry to Ontario. Holland Wheeler, cy. engr.

Toledo, O.—Sealed bids are asked until March 4 and 18 for paving certain streets with vitrified paving brick or block, asphalt blocks, Kreodone creosoted blocks or sheet asphalt. J. E. Connel, cy. clk.

Des Moines, Ia.—Sealed bids are asked until March 5 for 3,362 sq. yds. of brick paving and six-inch concrete base on Mary-ave. and Second and Depot-sts. G. A. Eberhart, J. E. Stout, B. P. W.

Atlantic City, N. J.—Sealed bids are asked until March 6 for constructing 12 mls. of gravel road from May's Landing to Pleasantville. John T. Irving, dir., Elwood, N. J.; J. J. Albertson, engr., Magnolia, N. J.

St. Louis, Mo.—Bids are asked until March 4 for repairing the government roadway, from Cache river bridge, in Pulaski county, Illinois, to the graded roadway extending from Mound City, Ill., to National cemetery, near that city. D. D. Wheeler.

Havana, Cuba.—Bids will be opened for street paving April 3. Bidders must deposit $500,000 with their bids, and the successful bidder will be required to give $1,000,000 security, in cash or bonds, besides paying the Cuban government $250,000 on account of the extinguished rights of M. J. Dady, W. J. Borden, U. S. engineers, chief engineer of city; Alexandro Rodriguez, mayor.

Waukesha, Wis.—Sealed bids are invited until March 2 for paving West-ave., from Dunbar-ave. to Main-st., as follows: Exc., 2,100 cu. yds.; setting combination curb and gutter, 3,000 lin. ft.; macadam paving, 6.150 sq. yds.; cast-iron gutters, 33 lin. ft.; brick gutters and walks, 38 sq. yds.; gutter bridges, 16 lin. ft.; catch basins and gutters. John P. Day, chmn. B. P. W.

Garrett, Ind.—Sealed bids are asked until March 5 for paving Randolph-st., from the north to the south corporation limits, 27,000 sq. yds., with paving brick. The work will include 11,000 cu. yds. of excavation; 9,200 lin. ft. 4x20 straight curb; 1,200 lin. ft. 3x15 marginal curb; 960 lin, ft. 4x20 radial curb; 36 new street inlets; 2 new manholes; 8 old manholes, tops to be adjusted; 6.175 sq. ft. new cement walk and gutter. T. J. Loar, cy. clk.; J. J. Van Auken, engr., Auburn, Ind.

CONTRACTS AWARDED.

Buffalo, N. Y.—The contract for improving Tifft-st. was awarded to Henry P. Burgard for $9,750.

Atchison, Kas.—The contract for grading, curbing and paving Fifth-st. was awarded to Wines & Co. for $3,431.71.

Anderson, Ind.—C. J. Miller & Co. of Seymour secured the contract for constructing seven sections of gravel road in Stony Creek twp. for $23,359.

Indiana, Pa.—The contract for constructing three miles of highway in West Wheatfield twp. was awarded to R. A. Reighard of Johnstown, Pa., for $8,995.

San Francisco, Cal.—The City Street Improvement company was awarded the contract for paving Sacramento, Clay and Washington-sts., between Montgomery and Sansome, with asphalt on 6 in. concrete base for $5,790.12.

Toledo, O.—Contracts have been awarded to C. H. Burchenal for asphalt block paving as follows: Greenwood-ave., from Miami to Yondota, $5,241.04; Stratton-st., from Miami to Yondota, $6,828.49; Yondota-st., from Nevada to Greenwood-ave., $6,550.19.

St. Paul, Minn.—Fielding & Shepley secured paving contracts as follows: Wabash-st., from College to University, sandstone, $18,490 for city's portion and $14,272 for street railway's share. W. Seventh-st., from Third to Ramsey, sandstone block, $13,800 and $8,300.

Niagara Falls, N. Y.—(Special)—F. J. Sullivan, cy. clk., says paving contracts were awarded Feb. 7 as follows: Buffalo-ave., from Portage-road to Twenty-fourth-st., asphalt, Barber Asphalt Paving company, $35,-170; Buffalo-ave., from Twenty-fourth-st. to Sugar-st., asphalt, Henry Burgard, $34,475.50.

Chicago, Ill.—Contracts for cement walks along various streets have been awarded to the Sennott Construction company, 84 Washington-st.; Thomas J. Burke & Co., 115 Monroe-st.; Perkins Const. company, Builders' and Traders' Exchange Bldg.; John A. McGarry & Co.

Marion, Ind.—(Special)—The contract for paving Homeward-boulevard with asphalt was awarded Feb. 20 to the R. F. Conway company of Chicago as follows: Asphalt paving, 34,334 sq. yds., $1.93 a sq. yd.; Berea curb, 5x24, 19,088 lin. ft., 45 cents; limestone curb, 4x18, 1,582 lin. ft., 35 cts.; masonry, 1,198 cu. yds., $7.50; bridge, $12.450; iron pipe, 540 lin. ft., $3.40; masonry, 42 cu. yds., $4.50; a 10-inch sewer pipe, 225 lin. ft., 50 cents; 19 curb inlets and basins, $15; total, $99,162.82.

Columbus, O.—Bids for resurfacing Broad-st., from Taylor to Woodlawn-ave., were received Feb. 12 as follows: American Asphalt company, Trinidad binder course, $1.40 for 1 in. and $1.45 for 2 in. wearing surface; total, $12,243; Barber Asphalt Paving company, $1.55 for 1 in. binder course and 2 ins. wearing surface, total, $12,344; Cleveland Trinidad Paving company, $1.42 for 1 in. binder course and 2 ins. asphalt; A. G. Pugh, $1.52 for Trinidad pitch or land or Bermudez asphalt, and $1.60 for Kentucky rock asphalt; Shaffer Roofing company, $1.53½ for Kentucky rock asphalt.

SEWERS.

Galveston, Tex.—The board of aldermen passed a resolution Feb. 4 over Mayor Jones's veto to appropriate $93,600 to take over the sewer plant of the Galveston Sewer company.

CONTEMPLATED WORK.

Easthampton, Mass.—Plans are being prepared for improvement of the sewerage system.

Fremont, O.—Bids will be asked soon for sewers in Front, Tiffin and South-sts.

Rehoboth, Md.—Plans for a sewerage system have been adopted by the town commissioners.

Macomb, Ill.—(Special.)—City Engineer Holmes says about one and one-half miles of 15 in. sewers are contemplated.

Bound Brook, N. J.—An ordinance has been passed for a lateral sewer on Second-

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st. Engineer Doughty.

Sacramento, Cal.—Plans for a sewage pumping plant have been received according to press reports.

East Hampton, Mass.—The question of extending the outlet of the sewerage system is being considered.

Wakefield, Mass.—Plans for the proposed sewerage system have been approved by the state board of health.

Barberton, O.—An ordinance has been adopted for a system of storm sewers for district No. 1. Mayor McNamara.

Great Falls, Mont.—The sum of $25,000 has been appropriated for the extension of the Sixth-st. sewer.

Davenport, Ia.—The estimated cost of building the First district or East Davenport sewer is $20,115.

Danville, Ky.—Plans for a sewerage system are being made by Alvord & Shields of Chicago. J. B. Fisher, mayor.

Cohoes, N. Y.—Plans and specifications have been prepared for the sewers for the fourth section. Engr. Hayes.

Columbia, S. C.—(Special.)—D. B. Miller, cy. engr., says a sewerage system is contemplated for the entire city.

Kamloops, B. C.—The council has been requested to engage an engineer to prepare plans for a sewerage system.

Brockton, Mass.—The legislature has authorized the city to issue $100,000 bonds for additional sewer construction.

Taunton, Mass.—The board of aldermen are considering the question of appropriating $100,000 for sewer extensions.

Manchester, N. H.—The board of street commissioners have asked for an appropriation of $20,000 for building new sewers.

The question of issuing bonds for sewerage systems will be voted on as follows: Madison, Ill., April; Mt. Sterling, Ky.

Longmont, Col.—The citizens have requested the city council to make a preliminary survey at once for a sewerage system.

Iola, Kas.—Plans are being prepared for a sewerage system by Burns & McDonnell, of Kansas City, Mo. W. M. Knoff. cy. clk.

Williamsburg, Va.—T. Chalkley Hatton, C. E., Wilmington, Del., estimated the cost of building additions to sewerage and water works systems for this place at $30,000.

Petaluma, Cal. (Special)—N. S. Frost, cy. engr., says he has submitted plans for 11,000 feet of 6 in. sewers in various streets in the southeastern part of town.

Newport, Ky.—(Special)—W. L. Glazier, supt. pub. wrks., says 15,000 ft. of 2½ to 3½ feet brick or concrete main sewers, and 8 to 24 in. lateral sewers are contemplated.

Baltimore, Md.—Mayor Hayes will present a bill to the legislature providing for a sewerage system for this city. If passed the question will be voted on May 7.

New York City.—A resolution has been adopted by the board of public improvements to build a main sewer and disposal plant for Rockaway, at a cost of $300,000.

Hamilton, Ohio.—Ordinances have been passed for a storm sewer in Court and other streets and a sanitary sewer and house connections in a number of streets. M. O. Burns, cy. clk.

Wawatosa, Wis.—The state board of health approved Feb. 9th the plans and specifications prepared by John W. Alvord of Chicago, for a sewerage system and disposal plant. E. D. Hoyt, mayor.

Kankakee, Ills.—The estimated cost of the proposed sewerage system from a point near Chestnut-st. and Greenwood-ave. to the river, nearly a mile, is $19,500. Cy. Engr. Gregg.

Bozeman, Mont.—The city council has ordered the construction of a sewer which requires considerable cement. S. H. Crooks, Livingston, Mont., is making plans. W. S. Davidson, chmn. sewer com.

Sacramento, Cal.—The Sacramento council of federated trades favors the construction of a sewerage system, pure water and a system of water mains, a city hall and a modern high school building.

Pawtucket, R. I.—The purchase of at least four new catch-basin carts is recommended in the annual report of the board of public works. Wm. A. Barclay, comm'r. P. W. Geo. A. Carpenter, cy. engr.

Kingston, N. Y.—A plan of sewerage and drainage for the upper part of the city has been adopted. The plan embraces more than 25 miles of pipe sewers and purification plant for house sewage. Geo. N. Bell, cy. engr.

Columbus, O.—Rudolph Hering has been engaged to review all the work done heretofore regarding the sewerage and sewage disposal systems and report on the general problem and the nature and the cost of the works needed.

Attleboro, Mass.—Plans for a sewerage system and sewage disposal by intermittent filtration have been prepared by Snow & Barbour of Boston. The sewerage committee will report in March. E. S. Hooten, chmn. com.

The question of building sewerage systems is being urged at the following places: Indianola, Ia.; Pleasant, Cal.; Oswego Falls, N. Y.; Culpeper, Va.; Sumter, S. C.; Brockport, N. Y.; Opelika, Ala.; Webster, Mass.; Arlington, Mass.; New Canaan, Conn.; Oneonta, N. Y.; Gilman, Ill

Columbus, Ga.—(Special)—R. S. Johnson, supt. pub. wrks., says the city council passed resolutions Feb. 6 providing for an election to be held May 9 to vote on the question of using $125,000 bonds for the purpose of beginning the construction of a system of sanitary sewers.

Cleveland, O.—Plans for the outlet section of the intercepting sewerage system for the East Side has been approved by the board of control. This section extends from Manhattan beach to a point between Collinwood and Glenville, and will be 13 feet in diameter. The estimated cost is $320,000.

CONTRACTS TO BE LET.

Oklahoma City, Ok. T.—Bids are asked until March 4 for 15,000 ft. of pipe sewers. Cy. Comm.

Standing Rock, N. D.—Bids are asked until March 5 for a sewerage system. W. A. Jones, comr. Indian affairs, Washington, D. C.

Havana, Cuba—Bids will be opened April 3 for sewerage. W. J. Borden, U. S. engrs., ch. engr, of city; Alexandro Rodriguez, mayor.

Cleveland, O.—Sealed bids are asked until March 5 for sewers in Pearl and Petrie-sts. and Rhodes-ave. Walter P. Rice, dir. pub. wrks.

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Canton, O.—Sealed bids are asked until March 9 to furnish all street and sewer castings needed by the city for one year. Louis N. Ley, cy. clk.

Hackensack, N. J.—Sealed bids are asked until March 4 for 1,480 feet of 18, 15, 12-in. pipe sewers. Wm. E. Clarendon, pres. Hackensack Improvement Comm.

Chillicothe, O.—Sealed bids are asked until March 8 for 2,300 ft. of 24-in. storm sewer in Sugar-st. and 6, 8, 15-in. sanitary sewers in certain streets. R. H. Lansing, Jr., cy. clk.

CONTRACTS AWARDED.

Suffolk, Va.—The contract for a sewerage system was awarded to Guild & Co., of Chattanooga, Tenn.

Allegheny, Pa.—The contract for a sewer in Evergreen road was awarded Feb. 12 to Thomas Prosser for $8,205.

Bay City, Mich.—Henry McCauley was awarded a contract Feb. 11 for a sewer in N. Park-ave., for $1,647.75.

Long Island City, N. Y.—Bids were received Feb. 20 for sewers in Webster and Paynton-aves., and William-st., from nine firms.

Glenville, O.—The W. P. Rice engineering company secured the contract for building the South End sewers for $16,564.68.

Union, S. C.—The contract for building a sewerage system was awarded to George O. Tenney of Spartanburg, for $21,222.

Warsaw, Ind.—The contract for constructing three lateral sewers was awarded Jan. 29, to El Woods of Decatur, Ind., for $11,790.90.

Madison, Wis.—The contract for constructing septic tanks for the sewage disposal system has been awarded to J. P. Blake of Dubuque, Ia., for $7,020.

Plainfield, N. J.—Bids received Feb. 18 for improving the sewage disposal works, bids and appurtenances, from ten contractors. The contract has not been awarded.

Greenwich, Conn.—Bids were received Feb. 11 for building two miles of pipe sewers from thirteen contractors, the lowest being that of Daniel M. Rossen, Kingstown, Pa., $15,323.

Hartford, Conn.—The contract for a sewer in Smith-st., was awarded to C. H. Slocomb for $1,377.55. He also secured the contract, Feb. 13, for building sewers in Pope park for $4,586.33.

Syracuse, N. Y.—The contract for building the Ninth ward trunk sewer was awarded Feb. 11 to T. J. Baker, for $15,073.25 for web tile. Samuel Brown secured the contract for a 12-in. pipe sewer in Judson-st. for $440.43.

New York City, N. Y.—The lowest bids submitted Feb. 13 for sewers in the borough of Bronx were as follows: E. 189th-st., Thomas Kelly, High Bridge, N. Y., $9,158; Woodlawn Road, M. J. Leehy, 990 E. 156th-st., $11,010.

Petaluma, Cal.—(Special)—N. S. Frost, cy. engr., says that contract was awarded Feb. 18 for the Oak-st. sewer as follows: 262 lin. ft., 18-in. pipe, 97c per lin. ft.; one manhole, $24.50; 400 lin. ft., 18-in. pipe sewer, 93c.

WATER-WORKS.

Bills will be introduced in the Wisconsin legislature asking for the protection of public water supplies and for a state laboratory.

Seneca Falls, N. Y.—The Seneca Falls water works plant was sold at receiver's sale Feb. 17 to Payson Bros. of Maine, who held a mortgage of $60,000.

The New Jersey legislature has three water pollution bills before it. One authorizes the present state sewerage commission to organize a sewerage district and build sewage disposal works whenever municipalities, which it has notified to stop polluting the water of the state, have allowed half of the time limit to pass without taking action. A second bill provides for the creation of sewerage districts and the appointment of commissioners to relieve the streams of the state from pollution. This bill describes how the work should be done and the necessary money raised. Plans adopted by such district commissioners would be subject to approval by the state sewerage commissioners. The district commissioners would be appointed by the governor. The third bill incorporates the Lower Passaic sewerage and drainage district, comprising all those portions of Passaic, Bangor, Hudson and Essex counties which drain into the Passaic river below the Great Falls at Paterson.

CONTEMPLATED WORK.

Granite Falls, Minn.—The extension of the water mains is proposed.

Mitchell, S. D.—The enlargement of the water works system is contemplated.

Sault Ste. Marie, Mich.—The construction of an aqueduct water works system is urged.

Norfolk, Va.—A meter system is recommended by W. F. Brookes, cy. engr., in his annual report.

Geneva, Ohio.—Bids will probably be asked in March for a system of water works.

Cherryvale, Kans.—Plans and specifications have been adopted for a municipal water works plant.

Streator, Ill.—The Streator Aqueduct company contemplates putting in an addition to its filter plant this summer.

Salida, Col.—The city council voted to issue $24,000 bonds for the improvement and extension of the water works.

Cincinnati, Ohio.—Surveys for a water works system will be made soon. C. F. Musson, of Norwich, N. Y.

Columbus, Ind., (Special)—Levi Hege, cy. engr., says a 5,000,000 gal. pumping engine will be purchased this summer.

Ann Arbor, Mich.—A bill will be introduced in the legislature asking for authority to build a municipal water works system.

Osawatomie, Kans.—Plans and specifications will be made by Burns & McDonnell of Kansas City, Mo. H. S. Maynard, mayor.

St. Louis, Mo.—An ordinance is being prepared preparatory to the construction of a filtration plant for the World's Fair grounds.

Port Huron, Mich.—The Port Huron water board will recommend the purchase of a large engine for the pumping station on St. Clair river.

Newport, Ky. (Special)—W. L. Glazier, supt. pub. wrks., says about 3,000 or 4,000 feet of six to ten-inch water mains extension is proposed.

Shenandoah, Pa.—The employment of an engineer has been authorized to determine

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the best method for increasing the water supply. Water comm.

Sharpsburg, Pa.—The question of issuing $25,000 bonds for repairing and improving the water works and electric light plants is contemplated.

The question of issuing bonds for the construction of water works systems will be voted on at the following places: Ruthton, Minn.; Clara City, Minn.

Bills have been passed in the legislatures authorizing the construction of water works at the following places: Sunapee, N. H.; Clayton, Ala.; Decatur, Ala.

Monon, Ind.—The water commissioners have asked for permision to enlarge and better equip the water works system, at a cost of about $20,000.

Fort Collins, Colo.—A committee has been appointed to report on estimates and recommendations for the extension of water mains, T. H. Garrett, cy. clk., William Rist, cy. engr.

Pawtucket, R. I.—John H. Walker, chf. engr., recommends the construction of a filter in the yard at No. 2 station. William Barkley, com'r. bd. pub. wrks. George A. Carpenter, cy. engr.

Municipal ownership of water works is proposed at the following places: Grayville, Ill.; Vicksburg, Miss.; Waco, Texas; Canisteo, N. Y.; Racine, Wis.; Ocean Springs, Miss.

Wellsville, O.—A new pumping station, two 3,000,000 gal. pumping engines, new 16-in. force mains to reservoirs, and 14-in. distributing main, is contemplated. D. A. Davidson, supt. water works.

Minneapolis, Minn.—The legislative com- for the water works. Petitions have been received from about eight miles of water mains.

The question of issuing water bonds has been favorably voted on at the following places: Amherst, Wis.; Ft. Atkinson, Wis.; Rockwood, Tenn.; Hooper, Neb.; Wickliffe, Tenn.; Walhalla, N. D.; Tannersville, N. Y.

Boston, Mass.—The Metropolitan water board will begin this spring the construction of a new 300,000,000 gallon aqueduct, 13.4 miles long and extending from the Sudbury reservoir in Southborough, toward the Metropolitan water district.

California, O.—R. M. Quigley & Co. of St. Louis, Mo., desire to sublet certain work in the construction of the reservoir for the Cincinnati water works. The works include sandstone and brick masonry, paving, cement and concrete work. etc.

Lynn, Mass.—The water board voted to petition the city council to authorize the mayor to petition the legislature for permission to borrow $400,000 outside its debt limit for the purpose of developing the local water system by the creation of reservoirs.

Ft. Smith, O.—(Special)—W. H. H. Jenkins says the water works trustees are discussing the advisability of building a reservoir for supplying this city with water instead of direct pressure, as at present. A committee has been appointed to collect data and make recommendations regarding a reservoir or a good filtering plant as the best plan from a sanitary point of view.

The construction of water works systems is contemplated at the following places: Mt. Ayr, Ia.; Ewing, Neb.; Spencer, Ind.; Swedesboro, Pa.; Bessemer, Ala.; Langdon, N. D.; Silver Lake, Minn.; Wymore, Neb.; Mt. Sterling, Ill.; Webster, S. D.; Wier City, Kas.; Elk Point, S. D.; Kiester, Minn.; Flora, Ill.; Abingdon, Ill.; Newburn, Tenn.; Rankin, Ill.; Egan, S. D.; Piqua, O.; Earlville, Ia.; Fowler, Col.; Ocean City, Md.; Waterford, Pa.; Philippi, W. Va.; Marion, Ky.; Whitney Point, N. Y.

CONTRACTS TO BE LET.

Dover, N. J.—Bids are asked until March 14 for driving a test well.

Syracuse, N. Y.—Bids are asked until March 10 for building water works. A. G. Carlson, engr.

Auburn, N. Y.—Bids will be received until March 2 for furnishing a 10,000,000-gal. horizontal pump. Water bd.

Ottumwa, Ia.—Bids are asked until March 18, postponed from Feb. 11, for a water works system. E. Hogland, chmn. water comm.

Standing Rock, S. D.—Bids are asked until March 6 for a water works system. W. A. Jones, comr. Indian affairs, Washington, D. C.

Detroit, Mich.—Bids are asked until March 4 for the superstructure of an addition to the pumping station at Water Works Park. Benj. F. Guiney, secy. bd. water comm.

Dassel, Minn.—Bids are asked until March 6 for constructing and erecting a 100-ft. steel water tower, with tank, gasoline engine, engine house, mains, hydrants, etc. J. W. Norgren, rec.

Kenosha, Wis.—Bids will be received until April 2 for a 4,000,000-gal. vertical cross compound pumping engine, with necessary piping and accessories. Bidders must furnish plans and specifications. Water comr.

Cincinnati, O.—Sealed bids are asked until March 5 for furnishing water valves, sluice gates and mud valves for the settling reservoirs and for the pump mains from the Eastern pumping station, near California. Aug. Herrmann, pres. bd. trustees w. w. comrs.

Chicago, Ill—Sealed bids are asked until March 16 for furnishing cast iron rings and covers for hydrant chambers, cast iron water pipe, cast iron valve basin covers, special castings, hydrant and stop valve castings, etc. L. E. McGann, comr. pub. wrks.

New York City, N. Y.—Bids are asked until March 7 for furnishing hydrant catches and rollers, tapping cocks, etc., for boroughs of Manhattan and Bronx; furnishing and erecting two boilers and appurtenances, and for the removal of four old boilers at Prospect Pumping Station, Borough of Brooklyn. William Dalton, comr. water sup.

CONTRACTS AWARDED.

Menasha, Wis.—A franchise has been granted to J. P. Miller & Co. of Chicago for a water works and an electric light plant.

Rochester, N. Y.—The contract for furnishing 835 water meters was awarded to the Hersey Meter company of Boston for $5,770.85.

Cape May, N. J.—The contract for extending the water supply system was awarded Feb. 9 to Edward W. Cresse for $9,640.

Woodstock, Va.—G. L. McKain of Salem, W. Va., was awarded the contract Feb. 14 for a water works system for $18,200.

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Petersburg, Ind.—The contract for a municipal water works system was awarded Feb. 20 to Frank Schefold of New Albany for $28,000.

Dallas, Tex.—The contract for a new storage reservoir has been awarded to Dan Morgan of this city for $41,000. Other contracts were awarded to Abendroth & Root of New York City and the Dimmock Pipe company of Birmingham, Ala.

Philadelphia, Pa.—The contract for a filter plant at Roxborough has been awarded to Daniel J. McNichol for $229,083, according to press reports. He also received the contract for supplying and laying water pipe, furnishing stop cocks, stop boxes, etc., for $669,633.

BRIDGES.

New Hope, Ala.—A steel drawbridge across Paint Rock river is contemplated.

Gonzales, Tex.—Bids are asked until March 4 for building three steel bridges.

Joplin, Mo.—Bids will be asked soon for the Lone Elm bridge across Turkey creek.

Waukesha, Wis.—Plans for a bridge at Locust-st. have been adopted by the council

Wabash, Ind.—Bids are asked until April 1 for building five county bridges. B. F. Cirmans, co. audt.

Pittsburg, Pa.—A new bridge will be built this spring to replace the present structure at Lincoln-ave.

Topeka, Kas.—A bill has passed the senate authorizing Shawnee county to build four bridges across Kansas river.

Princeton, Ind.—Bids are asked until March 6 for 18 iron county bridges. Jonathan W. Phillips, chmn. bd. co. com's:

Devils Lake, N. D—The citizens of this place have subscribed $7,000 for the construction of a bridge across the lake

Pekin, Ill.—The commissioners of Dillon twp. contemplate building a bridge over the Mackinaw river at Morrismill ford.

Selin's Grove, Pa.—The viewers have decided to build a bridge across the Susquehanna river, between Herndon and Port Treverton.

Madison, Neb.—Sealed bids are asked until March 18 for all pile and iron bridges to be built during the year. Phil Bauch, co. clk.

Jamestown, Ind.—The county commissioners have been petitioned to biuld a bridge across Bango creek, between Wakarusa and Jamestown.

Parker, S. D.—Bids are asked until March 4 for a steel bridge over Vermilion river, Marion twp. Joseph J. Waltner, Jr., co. audt

Concord, N. H.—A bill has passed the legislature authorizing the construction of a free bridge across the Connecticut river at Dalton.

Perth Amboy, N. J.—A committee has been appointed to consider plans for a bridge over the Raritan river between this city and South Amboy.

Delphi, Ind.—Sealed bids are asked until March 4 for building an approach to a bridge in Burlington twp. John Nevin, chmn. co. com's.

Chillicothe, O.—Sealed bids are asked, until March 5, for a 135-ft. bridge over the north fork of Paint creek. A. W. Jones, co. surv.

Hardin, Ill.—Bids are asked, until March 18, for the steel superstructure of a bridge over Crawford Creek. Chas. Flamme, co. clk.

Rowlesburg, W. Va.—Bids will probably be asked next summer for a steel bridge over Cheat river. Geo. H. Walls, clk. co. court, Kingwood.

New York City.—Surveys and plans have been made by Engineer Schenck for a steel plate girder bridge across East Charter creek, in Pelham Bay Park.

Columbus, O.—Sealed bids are asked, until March 13, for substructures, superstructures and paving of certain bridges. L. E. Jones, co. audt.

Lowell, Mass.—The street committee voted to instruct the city engineer to prepare plans for a 50 ft. bridge to replace the present Pawtucket bridge.

Chatham, Ont.—Bids are asked, until March 8, for constructing a steel trestle approach to a bridge across the Thames river in Kent county. J. C. Fleming co. clk.

Rensselaer, Ind.—Plans and specifications for two bridges in Marion twp. and one each in Walker, Jordan and Newton twps., will be prepared by G. P. N. Saddler.

Grand Rapids, Mich.—Sealed bids are asked, until March 8, for constructing Bridge-st. bridges over East and West Side power canals. Dudley E. Waters, prest. B. P. W.

Michigan City, Ind.—Bids will be received until March 14 for constructing a drawbridge to span the harbor at Seocnd-st. Francis H. Doran, Co. Audt., Laporte, Ind.

Defiance, O.—Sealed bids are asked until March 11 for the construction of two stone abutments for a bridge across Tiffin river, in Noble twp. Peter Coressel, chmn. co. coms.

Atlantic, Va.—The board of local improvements has given the West Ghent company permission to construct a bridge 300 ft. long across Farrants creek, at an estimated cost of $12,000.

Duluth, Minn.—Bids are asked, until March 25, for the construction, operation and maintenance of a ferry bridge across the ship canal, at Lake-ave. T. W. Hugg, chmn. special ferry br. com'n.

Nashville, Tenn.—The committee has submitted estimates to Mayor Head for a bridge across Cumberland river, at Broad-st., as follows: Low bridge, with a draw, $282,500; high bridge, without a draw, $386,700.

French Indo China.—Bids will be received until May 9 by the director of public works for Cochin China, at Saigon, for a bridge over the Arroyo Chinais. For particulars address Inspector-General of Colonies, Ministry of the Colonies, Paris, France.

Frankfort, Ind.—Sealed bids are asked until March 5 for the construction of a number of steel bridges. Bids will be received until March 18 for the construction of stone abutments and substructures for these bridges. Wm. H. Jenkins, chmn. bd. co. comrs.

Indianapolis, Ind.—Contracts for three bridges have been awarded as follows: Big Eagle Creek in Reveal road, Indianapolis Bridge & Iron Works, $5,498; Big Eagle Creek bridge, Crawfordsville pike, American Bridge company, New York City, $4,175; White river bridge at Broad Ripple, super-

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structure, American Bridge company, $17,-295, substructures, $9,828.

Cincinnati, O.—Plans have been approved for a steel viaduct across the railroad at Delta river. The viaduct proper will be 842 ft. long, with an eastern masonry approach of 45 ft., and a western approach of 48 ft., making a total of 9,395 ft. The roadway will be 38 ft. wide and paved with asphalt, with 7-ft. stone flagging sidewalks; estimated cost, $175,000.

PARKS.

Macon, Ga.—The improvement of Tatnall Square park is proposed.

Atlanta, Ga.—A new park near Davis-st. school is contemplated by this city.

Huntsville, Ala.—The establishment of a handsome park is contemplated by the Huntsville electric street Railway Light & Power company.

A circular regarding Michigan wild flowers for summer planting, which has been issued by Wilfred A. Brotherton of Rochester, Mich., is of special interest to those in charge of parks and cemeteries.

STREET LIGHTING.

Bridgeport, Conn.—A municipal light plant is proposed.

Avoca, N. Y.—A municipal electric light plant is proposed.

Sioux City, Ia.—A hot water heating plant is contemplated.

Odebolt, Ia.—An electric light and hot water heating plant is contemplated.

Liveoak, Fla.—Bids are asked until March 18 for constructing an electric light plant. C. Y. Byrd.

Chattanooga, Tenn.—Plans will be prepared at once for the proposed plant. W. I. Williams, chm. com.

Batavia, N. Y.—Dr. Richardson and F. J. Judd have petitioned for a franchise to pipe the streets and furnish gas

The question of issuing bonds for electric lights has been favorably voted on at Charlemont, Mass.

Geddes, S. D.—Bids are desired for a complete plant of 800 to 1,000 lights. G. W. Morrow, secy. Geddes Light and Water company.

Suffolk, Va.—Bids are asked until March 15 for lighting the streets and public buildings. W. N. McAnge, chmn. com on lights.

Ft. Adams, R. I.—Bids are asked until March 14 for an electric light plant. Maj. Geo. W. Gottals, U. S. Engr., Newport, R. I.

Tarrytown, N. Y.—The question of building a municipal light plant will be voted on soon, according to press reports.

Bills have been passed in the legislature authorizing the issue of bonds for electric light plants as follows: Clayton, Ala.; Roanoke, Ala.

Galion, O.—A franchise will probably be given to the Delaware Electric Light, Heat and Power company, to heat this city by a hot water system.

Hampton, Va.—Mayor Hope has been authorized to appoint a committee to investigate the question of establishing a municipal electric light plant.

Lexington, Miss.—Bids will be desired about April 1 by the Ice, Light and Water company for erecting a 100-K. W. plant. E. C. DeLang, mgr.

Manning, Ia.—The question of granting a ten-year franchise will ve voted on the last Monday in March.

Portland, Me.—Sealed bids are asked until March 11 for an electric light plant for Ft. Williams, Me. S. W. Roessler, maj. engrs.

Creston, Ia.—A five-year contract has been awarded the Creston Gas and Electric company for furnishing 23 arc lights of 2,000 c. p. at $76 per light per year.

Rochester, N. Y.—Bids are asked until March 15 for an engine, generator, switchboard and pole line at the Rochester state hospital. Fred Cook, pres. bd. mgrs.

Port Austin, Mich.—Bids are asked until April 1 for furnishing one 500-lgt. dynamo, 1,000 incandescent lamps, etc., for the proposed municipal plant. W. L. Larned.

Ripon, Wis.—Bids are asked until March 5 for a franchise for an electric light plant for 5 to 15 years; also furnishing 110 incandescent and 7 arc lights. T. W. Allen, cy. clk.

Oshkosh, Wis.—Mayor Mulva, Aldermen Weisbrod, Newman, Simpson and Warren comprise a committee to investigate the best and cheapest method of lighting the streets and bridges of this city.

Pekin, Ill.—The Pekin Light, Heat and Power company has been granted a 25-year extension of their franchise, in consideration of which the company has reduced the price of arc lights from $85 to $65 per month.

York, Pa.—The contract for lighting the city for one year was awarded to the Edison Electric Light company of this city at 20½ cents per light per night, for every night and all night for 288 2,000 c. p. arc lights or more.

St. Joseph, Mich.—According to local press reports fifteen business men will build and donate to the city a $15,000 electric light plant if the common council will give them $70 a light for three years for street illumination, the plant to be transferred to the city at the end of that time.

The question of issuing bonds for the construction of electric light plants will be voted on at the following places: Maple Lake, Minn.; Hedwig, Ia., March 4; Guthrie, Ia.; Lamberton, N. C., March 1; Carsonville, Mich.; Dublin, Ga., March 12; Napoleonville, La.; Jonesboro, Tenn.

Syracuse, N. Y.—The board of contract and supply awarded a five-year contract Feb. 11 to the Electric Light and Power company at 23½ cents a night for arc lights and 8 cents a kilowatt for incandescent lighting for city buildings. Justice W. C. Scripture immediately granted an injunction restraining the mayor and electric light company from signing this contract.

The construction of electric light plants is contemplated at the following cities and towns: Ellisville, Miss.; Sisseton, S. D.; Tacoma, Wash.; Chatham, N. J.; Ravenswood, W. Va.; Dickson, Tenn.; Lincoln, Ill.; Weir City, Kas.; Provincetown, Mass.; Hawkinsville, Ga.; Scotland Neck, N. C.; Scribner, Neb.; McIntosh, Minn.; Menasha, Wis.; Talladega, Ala.; Thorp, Wis.; Tiskilwa, Ill.; Toledo, Ill.; Johnstown, O.; Lompoc, Cal.; Pennville, Ind.; Red Lion, O.; River Rouge, Mich.; Midway, Ky.; Fredericktown, O.;

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Greensboro, N. C.; Hammondsport, N. Y.; Hampton, Va.; Hogansville, Ga.; Archbold, O.; Fulton, N. Y.; Sherrard, Ill.; Kinsley, Kas.; Winona, Minn.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Montreal, Quebec.—The question of building an incinerator in the East End is being considered.

Elgin, Ill.—The council has appropriated $5,000 for a garbage crematory, according to press reports.

Chester, Pa.—Rates will be asked soon for cleaning the paved streets, and for garbage collection, Cy. clk.

Pawtucket, R. I.—Bids will be received March 6 for the removal of dead animals, etc., for a term of five years. Cy. clk.

Lowell, Mass.—Councilmen Browneau, Clark and Legare have been appointed a committee to consider a better method of disposing of the garbage waste, etc.

Brantford, Ont.—Mayor Wood, A. F. Vaughan, Joseph Bowes and D. J. Monahan have been appointed a committee to secure estimates for a garbage disposal plant.

Nashville, Tenn.—A resolution has been adopted providing that a committee be appointed to investigate and arrange a better system for disposing of the city's garbage.

Pawtucket, R. I.—The purchase of at least three new sprinkling carts during the coming season is recommended in the annual report of the board of public works. Wm. H. Bravely. com'r. pub. wks.; Geo. Carpenter, cy. engr.

Waukesha, Wis.—Sealed bids are asked until March 2 for two street sprinklers complete of 600 gals. each, with platform springs and a 4-in. tire, spray sprinklers and interchangeable parts. John P. Dey, chmn. B. P. W.

Detroit, Mich.—Sealed bids are asked until March 11 for collecting and disposing of the garbage of the city for terms of 3, 5, 7 and 10 years. Separate bids will also be received for the collection of garbage and for the disposal of garbage. F. A. Blades, controller.

Chicago, Ill.—A new municipal cleanliness ordinance was passed Feb. 18, which provides for two sets of wagons—one with a box of metal, waterproof and the other of the ordinary wooden variety. Garbage and other discarded material that is not classed as ashes will be thrown in the metal wagon and ashes in the ordinary wagon.

Atlantic City, N. J.—Bids were received Feb. 11 for a crematory as follows: Cramp & Co., Philadelphia, foundations, platforms, etc., $14,715; Henderson & Co., Philadelphia, foundations, platform, etc., $15,400; gas producer, $22,915; M. P. Wells & Co., Philadelphia, foundations, platform, etc., $18,118; Machin & Brown, Philadelphia, foundation, platform, etc., $13,887; gas producer, $22,137; the Hix & Sons company, Bridgeton, N. J., gas producer, $22,915.

TOO LATE FOR CLASSIFICATION

North Toronto, Ont.—A new water works system is contemplated.

Geddes, S. D.—A water works and electric light system is proposed.

Armour, S. D.—The construction of a sewerage system is contemplated.

Hopkinton, Ia.—The question of building water works is being revived.

Springfield, Mass.—This city contemplates doing its own street sprinkling this year.

Sparta, Wis.—The question of street paving will probably be voted on.

Minneapolis, Minn.—A new bridge across the Mississippi at Washington-ave. is proposed.

Berryville, Va.—The question of establishing an electric light plant is again being agitated.

Terre Haute, Ind.—An appropriation of $45,000 is proposed to build a new wagon bridge across the Wabash river.

Indianapolis, Ind.—Notice of intention has been published for building a sewer in W. Michigan-st. Albert Sahm, chmn. B. P. W.

St. Paul, Minn.—Preliminary orders were passed, Feb. 19, for paving Rice-st., from College to Front-st., with asphalt.

Bay City, Mich.—(Special.)—Geo. Turner, cy. engr., says 50,000 sq. yds. of brick paving on concrete foundation is contemplated.

Los Gatos, Cal.—The property owners in the Almond addition of this city will petition the town board of trustees for a sewerage system.

Dallas, Tex.—The water commissioners are not satisfied with the bids received for cleaning the reservoir site, and will probably readvertise.

Baltimore, Md.—Sealed bids are asked until March 11 for vitrified brick and rubble stone street paving. John De P. Douw, chmn. com. on sts.

West Duluth, Minn.—Bids will be asked soon on different kinds of material for paving Central-ave. Asphalt and creosoted block seem to be most favored.

Chicago, Ill.—Sealed bids are asked until March 4 for constructing cement sidewalks in portions of 49 streets. L. E. McGann, prest. bd. local impvts.

Knightstown, Ind.—The contract for a new electric light plant was awarded, Feb. 18, to the American Water and Light company of Indianapolis for $8,416.77.

Mackinac Island, Mich.—A franchise for water works, a sewerage system and an electric light plant was granted, Feb. 14, to Frank C. Andrews and associates.

Kenosha, Wis.—Sealed bids are asked until March 4 for constructing 9,552 ft. of 15 and 12-in. pipe sewer, 5 manholes and 4 catch basins. Gus Jacobs, cy. clk.

Troy, N. Y.—The question of public parks is being discussed. The contract for the extension to the water works was awarded, Feb. 19, to Martin Murray & Co., of this city for $8,044.95.

St. Louis, Mo.—An ordinance was approved Feb. 19 authorizing the construction of a covered reservoir on the water works property at Baden, and $260,000 has been appropriated for the purpose. Water com'r. Flad.

Buffalo, N. Y.—Sealed bids are asked until March 6 for paving Kingston place, Ryan and Sobieski-sts., and Yale place, for repairing Ohio, Hamilton, East, Seventh and Commercial-sts., and for macadamizing Florence-ave. R. G. Parsons, secy. B. P. W.

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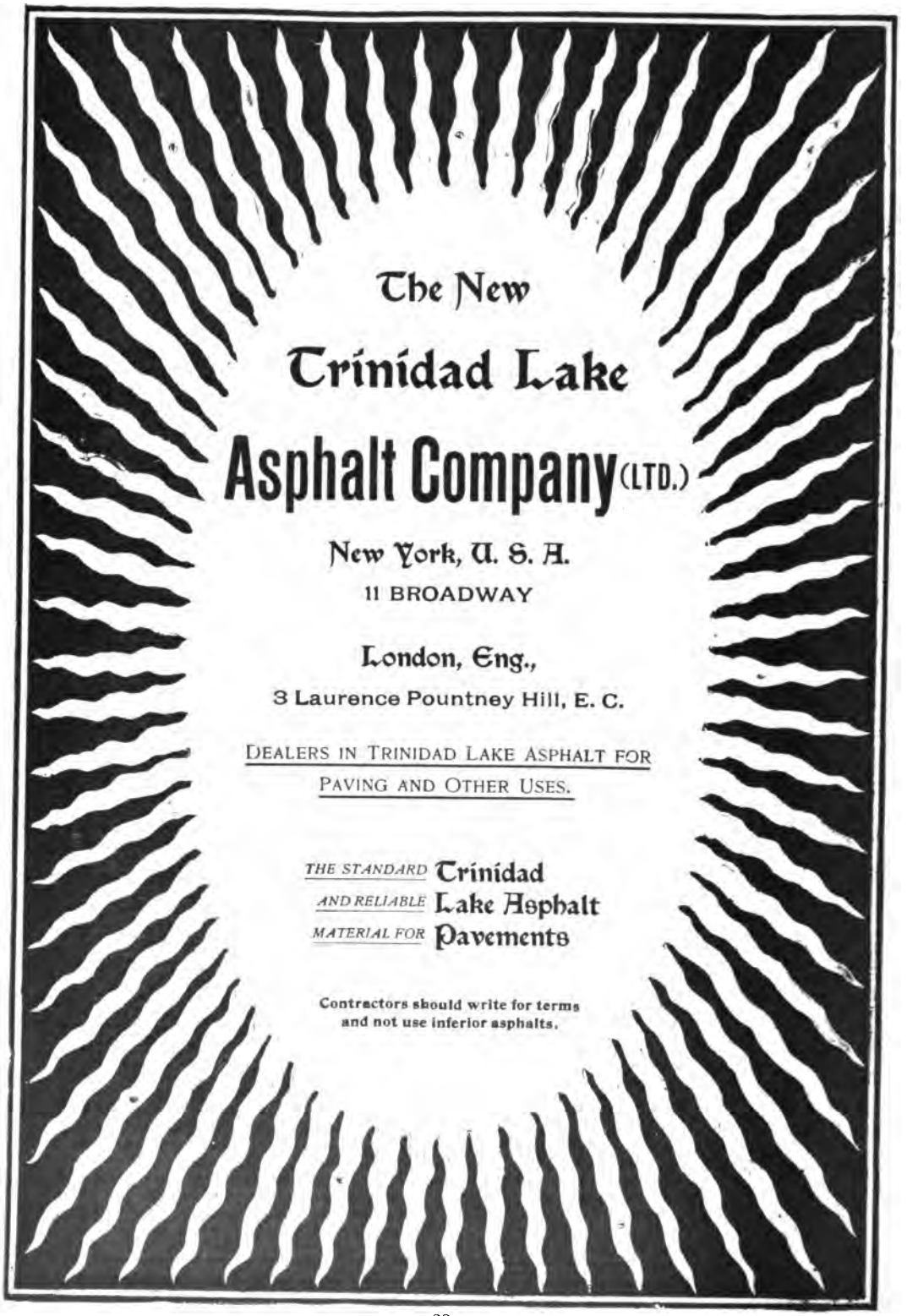

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Municipal Engineering

VOLUME XX. APRIL, NINETEEN HUNDRED ONE. NUMBER 4.

RATHMINES MUNICIPAL ELECTRICAL PLANT.

By Frank C. Perkins.

It may be of interest to note the details of a recent installation in England for supplying electric energy for light and power as operated by a municipality, as well as indicating modern English practice for generation and distribution of current for limited areas. The Rathmines Municipal Electrical Plant is installed for the three wire direct current system. Mr. G. F. Pilditch is resident engineer, and it is through his courtesy that the following data and the accompanying illustrations are presented.

The central station is located near the town hall on the council's land, and is a brick and stone structure. The present size of the engine and generator room is 37 feet by 48 feet, but provision is made for extension when desired. The boiler room is located parallel to the engine room, and is seen in one of the accompanying illustrations. The three boilers are each 8 feet in diameter, and about 30 feet long. They were built and installed by Robert Taylor & Sons of Marsden, England, and evaporate seven thousand pounds of water per hour. Vicar's mechanical stokers are used, and the boiler pressure is maintained at 160 pounds per square inch. Holden & Brooks injectors are employed, as well as a Green double-ram steam pump. The feed water is maintained at 160 degrees Fahrenheit, and is supplied by a Blake & Knowles single acting pump, driven by a direct current electric motor of the Lundell type. The feed water heater was installed by Spencer of Wednesbury, and the electric motors for operating the mechanical stokers and scrapers of the Green economizer are of Crompton make. The economizer has 96 tubes and as usual is placed between the boilers and the stack.

Small motors are supplied with current in the various sections of the city from 220 volt circuits while motors of over 7-horse power capacity are operated from the 440 volts conductors of the three wire system.

The lighting circuits and present generating plant can supply more than 20,000 lights, while the capacity may be increased to 30,000 lights by the aid of the accumulator plant. The peculiar arrangement of the direct-connected engines and generators may be noted in the accompanying illustration. Instead of placing one generator on each side of the engine and direct connecting, the engine is placed on one end of the common base and the two generators connected together as shown.

The engines are of the Willans triple expansion compound type, the larger engine having nine cylinders and three cranks and driving the multipolar direct current generator at 320 revolutions per minute. These dynamos are of Mather & Platt design and have a capacity of 300 kilowatts, the steam consumption for this combination being a trifle less than 25 pounds per kilowatt-hour. This engine is automatically lubricated, is provided with steam separator, and a jet condenser with a steam driven direct acting pump in the cellar. The vacuum is maintained at 26 inches. A Klein cooling tower is employed having a capacity of 40,000 gallons of water per hour, the water being reduced in temperature 30 degrees Fr., natural draught only being required in the tower. The smaller engine and direct coupled generators have a capacity of 150 kilowatts, and the engine, which is a compound, four cylinder two crank vertical engine, operates the set at a speed of 360 revolutions per minute. The steam pressure under normal working condition being 150 pounds per square inch, the steam consumption of this engine is said to be under 30 pounds per kilowatt hour.

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The storage battery plant consists of 274 Tudor cells containing 13 plates each. They are installed in two sets with 49 cells for regulation on each side of the neutral. The accumulators have a total capacity of 800 ampere hours at a 10-hour rate, and with a potential of 500 volts. A Mather & Platt motor-generator is used in connection with the dynamos in charging, the normal and maximum rates of charge being 120 and 150 amperes. The discharge may be from 100 to 200 amperes. A 10-ton crane is shown in the background of the illustration of the engine room, which was taken from a position on the switchboard gallery. The crane was installed by Higginbottom & Mannock of Manchester, England. The switchboard gallery seen in the foreground is 30 feet long and raised several feet above the engine room floor. The switchboard is nearly 20 feet long, and mounted on a base nearly 2 feet above the gallery floor. It consists of three panels, the center panel being equipped with the necessary voltmeters, battery regulators, neutral bar, together with the Booster ammeter and switch, while the two outside panels are supplied with Bus bars, feeder switches, generator ammeters, generator switches and rheostats. The switchboard and instruments and switches were installed by James White of Glasgow, who manufactures the celebrated Lord Kelvin instruments.

The main and feeder cables are triple concentric, paper-insulated, lead-covered cables nearly .5 square inch in cross-section, laid in cast iron underground troughs filled with resin oil and pitch. Nearly 50 miles of cable are in use; those supplying the arc lights, about 100 in number, are $\frac{7}{8}$ single cables, while all the incandescent work is supplied with concentric cable construction. The arc lamps are placed about 200 feet apart, on artistic iron poles about 20 feet high. There are nine lamps in series, about a dozen circuits being used. The cables were installed by the British Insulated Wire Company, and the arc lamps by Verity of London.

BOILER ROOM, RATHMINES MUNICIPAL ELECTRIC PLANT.

The total cost of the plant is about $400,000, including the central station, lamps, and mains. Several thousand incandescent lamps of 8 candle power are used, this small unit being more extensively used in England than in America.

The rate charged for power and heating current is about 6 cents per kilowatt, while for lighting the rate is 12 cents per kilowatt, 5 per cent. discount from these rates being allowed. Upon application for light the wires and fittings are installed free of expense to the consumer, who pays for the

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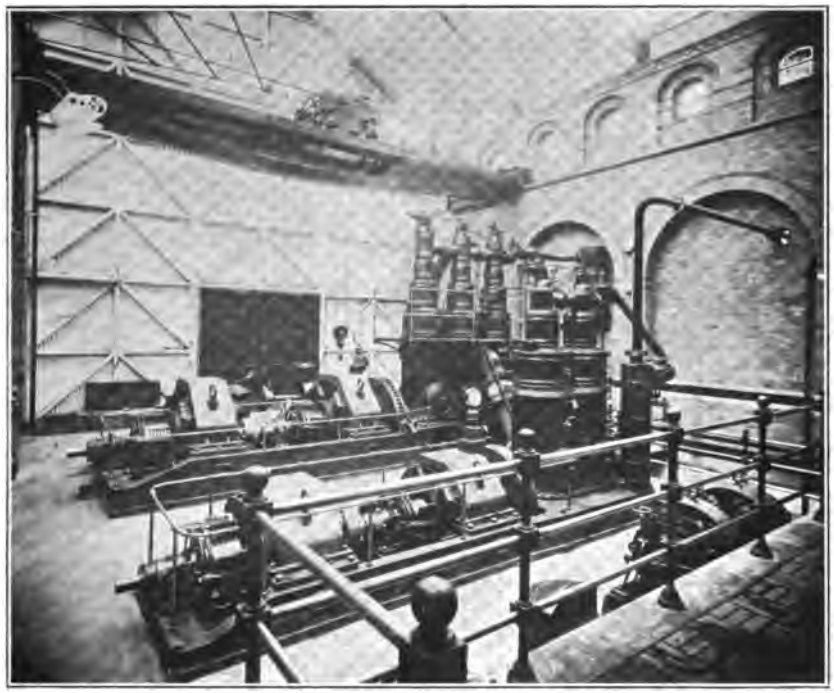
same by an additional rate of 2 cents per kilowatt being added to his bill. This is known as the free wiring scheme of the National Electric Company of London, and has been recently introduced by the Rathmines electric lighting committee, for the benefit of consumers who do not care to expend the necessary capital to install the wires and fittings on their premises. The entire plant was installed under the supervision of Mr. Robert Hammond, the consulting engineer.

CENTRAL STATION HEATING.

The business of central station heating has passed through its preliminary stages during the past five years and has practically demonstrated the feasibility and the convenience of this method of distributing heat. What may be called the experimental stage has not yet passed entirely and new applications and new economies are being discovered from day to day. From a paper by Wm. H. Bryan, of St. Louis, before the American Society of Heating and Ventilating Engineers, have been selected the quotations upon the general subject of central heating stations which follow, the paper presenting the basis upon which the methods rest their claims for utility and economy very concisely and clearly.



ENGINE ROOM, RATHMINES MUNICIPAL ELECTRIC PLANT.

"Many methods of central station heating have been employed, but they have now been reduced to practically two—steam and hot water. Central station heating follows the same general laws which govern isolated installations. When the sale of steam is the main business of the plant, and there are no engines on which low back pressure must be carried, the steam pressure is high enough to force circulation to extreme distances, and in some cases even to run engines. Pressure reducers are supplied at the point of use to give the customer whatever indoor or secondary pressure he needs. Where part of the steam supply is from the exhaust of engines driving dynamos—as is often the case in modern plants—the pressure must be so low as not to interfere with the proper working of the engines.

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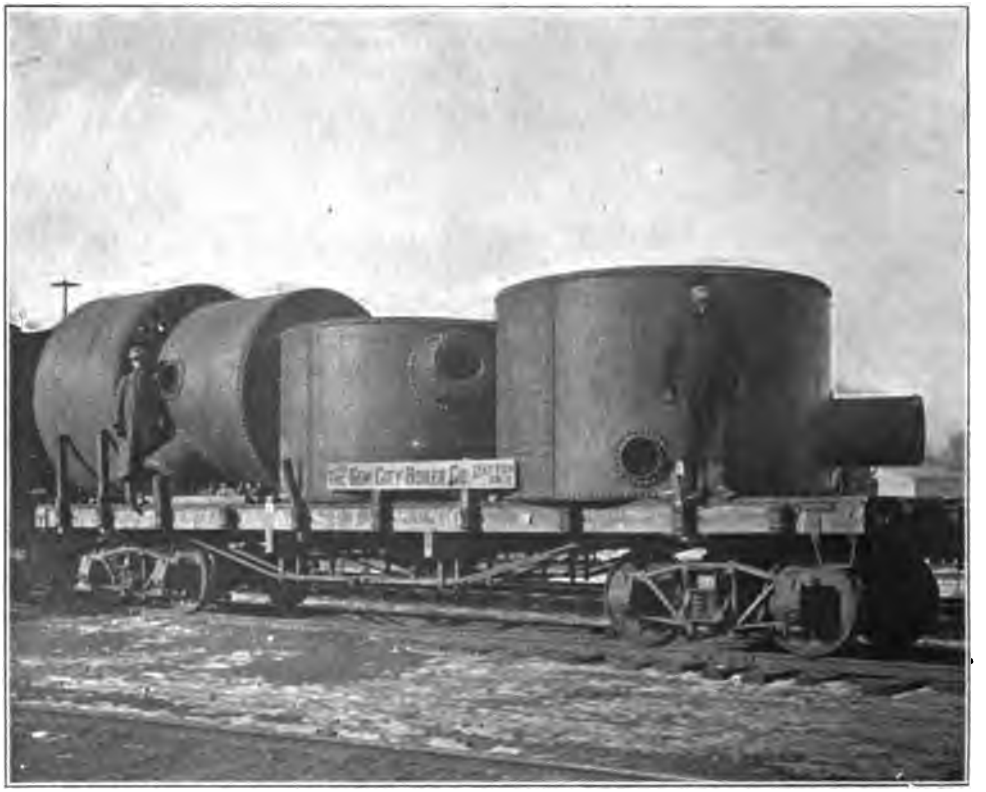
This necessitates larger mains, and is sometimes accompanied by difficulty in securing prompt and effective circulation. It does not pay to bring back the returns to the station. The cost of the second pipe, properly insulated, its rapid deterioration, and the frequent presence of oil or other foreign matter, has led to the abandonment of this practice. It is customary to install an economizing coil near the front of the house, over which external air is admitted, giving the necessary indirect heating and ventilation. The returns from the radiators pass through this coil, giving up practically what heat is left in them, and are then trapped to the sewer.

"Hot-water systems are usually operated from central electric plants utilizing their exhaust. This is passed through closed exhaust heaters of large capacity, the outlet being to the atmosphere either direct or through a back-pressure valve. If the heaters are of ample capacity and properly arranged, there need be no back pressure. The water may be given any desired temperature up to 212 degrees Fahrenheit, and is circulated by steam pumps. There is an outgoing and return main, the distribution being what might be called multiple-series. At each building served, a connection is taken from the supply main and serves the radiators, which are themselves in series or multiple-series. The returns are finally collected and go to the return main. There are a few instances of single-pipe mains, the returns going back to the same main, being diverted to the house by a shunt."



SMEAD'S BOILERS EN ROUTE FOR CENTRAL HEATING STATION AT WASHINGTON COURT HOUSE, OHIO.

A central heating station has just been completed at Washington Court House, Ohio, by the Central Heating Station Company, of Cincinnati, which is designed as a heating station with no provision for the use of the station for other power purposes. The special design of vertical boilers in standpipe form utilizes so large a proportion of the heat from the furnace that the plant is expected to compete successfully with those in which heat is a by-product, or in

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which a by-product of electric current can be sold to help in increasing the income. The form of the boilers can be seen in the illustration, showing a car-load of them en route, and in that showing a boiler on its way to position in the stack.

"There are two methods of regulation. In some cases the water is sent out at a constant temperature, and each individual user controls his radiators just as he would his own plant, turning them on and off at will; or he may regulate them automatically by thermostats; or the entire plant may be handled by thermostats. In such an installation the speed of the pump varies, being controlled either automatically by a thermostat, or by an attendant who judges of the heat requirements by the temperature of the return water. In other installations the pump is operated at a fixed speed, the temperature of the water being changed with the weather. By adjusting the radiator valves of such installations the proper amount of water can be kept circulating through them, the customer thus being relieved of all care in the matter of regulation. The station attendant keeps close watch of an external thermometer, and raises or lowers the temperature of the outgoing water to correspond.

ELEVATING TO POSITION A SECTION OF SMEAD'S STAND PIPE BOILERS AT CENTRAL HEATING STATION, WASHINGTON COURT HOUSE, OHIO.

"When the exhaust is insufficient, live steam may be admitted to the heaters, just as it would be turned into the mains with the steam system. In either case, separate boilers may be fired, discharging steam or hot water directly into the mains without

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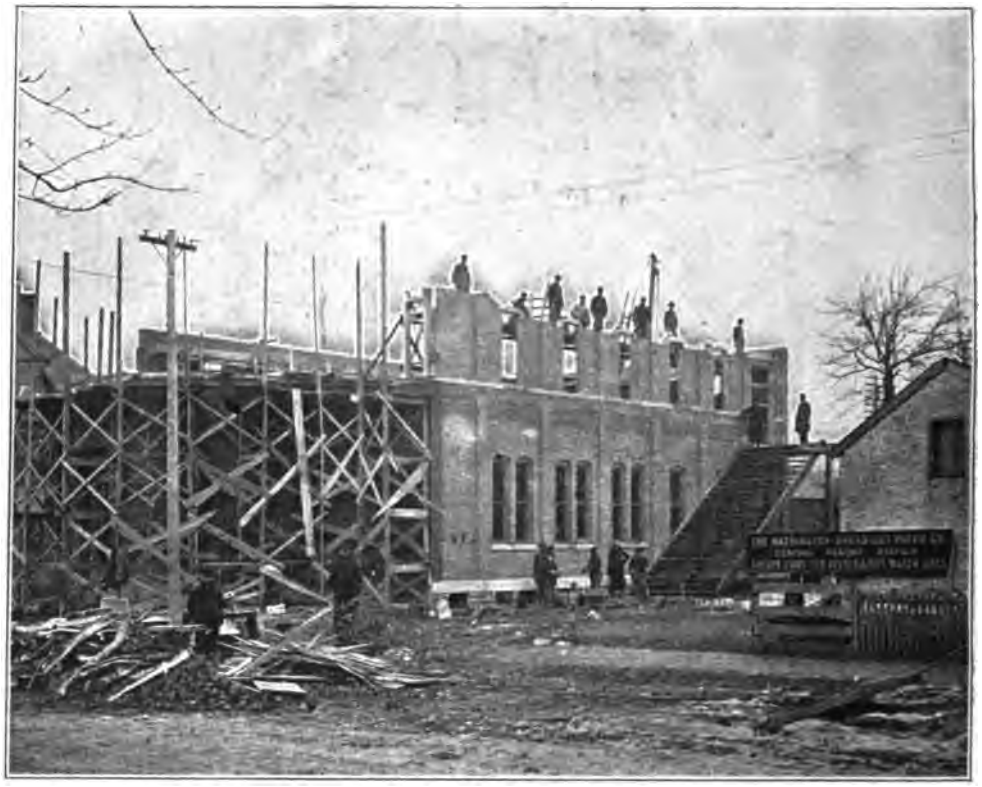
the intervention of engines or heaters, a practice often followed.

"One difficulty arises in that the use of exhaust steam has usually necessitated a considerable back pressure on the engines, thus straining them beyond what they were built for, and reducing both their capacity and efficiency. The situation is improved by separating the exhaust into two mains, and allowing only a portion of the engines to exhaust into the heating mains when the demand for heat is small. The exhaust from the remaining engines then goes direct to the atmosphere, without back pressure, or to the condenser.

"The following points of advantage appear to be with the steam system: 1. Simplicity, there being a single pipe line, and no pumps being necessary. 2. The equipment or plant appears to be more durable. The life of underground pipe lines carrying steam has been shown to be much greater than those carrying hot water. 3. The investment in radiators for utilizing the heating service is less by the usual ratio between steam and hot water radiators. 4. The system will satisfactorily serve buildings which have been equipped for either steam or hot water heating. A hot-water plant can not handle a building equipped for steam heat, except at the expense of reconstruction. 5. Less pressure being carried, there will be fewer leaks, and less liability to damage in case of accident. 6. Leaks may be repaired, valves packed, etc., without the necessity of shutting off the entire house. 7. The steam people have whatever advantage results from long experience in the heating business, and the construction and operation of many plants under wide ranges of conditions.

"The following advantages appear to be with the hot-water method: 1. Cheapness of installation, although this is to some extent offset by the necessity for a return line. The low temperature makes it unnecessary to provide as many expansion joints, or to use as high a grade of insulating material, while the fact that the medium is water renders sub-drainage unnecessary. 2. Milder



VIEW OF SMEAD CENTRAL HEATING STATION, WASHINGTON COURT HOUSE, OHIO.
Second Story to be Used as Public Library.

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temperature, which is preferable in radiators, hot water now being used almost exclusively for residences. The low temperature also reduces the radiation losses, which are proportional to the differences of temperature. 3. There being no waste to sewer, either at low points or at discharge from residences, there is no loss of water or heat at these points. 4. Water appears to adapt itself readily to regulation, either automatically or by an attendant at the station. 5. Water appears to lend itself better to heat storage, which would improve the economy at the station. 6. Operation without back pressure. While this is of less importance than would appear at first glance, it nevertheless should have the earnest attention of the steam advocates. 7. There are no offensive odors from the air valves of stuffing boxes of radiators. 8. It would appear to be easier to discover and locate serious losses of water or heat.

"There appears to be no choice between the two systems in the matter of power required to circulate the heating medium.

"It would appear possible to meter both systems. The use of steam could be measured either directly by steam meters or by hot-water meters on the returns. In those water systems carrying constant temperature and changing the speed of pump to suit the demand, the water could also be metered. This could not be done, however, where the speed of pumping is constant and the temperature is varied.

COURT HOUSE AND JAIL, HEATED FROM CENTRAL STATION, WASHINGTON COURT HOUSE, OHIO, USING SMEAD'S STAND PIPE SYSTEM AND HOT WATER LINES.

"The rates charged for heating in different cities and under different conditions vary considerably. The conditions controlling the price are the cost of fuel, the distance the service is carried, range of external temperature, and number of months of service. In most cases the charge is for a season's service, and is based either upon the square feet of radiation, or 1,000 cubic feet of space heated. The rates for hot water vary be-

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tween 12½ cents and 20 cents per square foot of radiation. For steam, the range is from 15 cents to 30 cents, although a rate of 50 cents is reported from Seattle. The charges run from $2.50 to $5 per 1,000 cubic feet of space heated, which, of course, is independent of whether steam or water is used. A slightly higher charge is made for indirect radiation. When steam is sold by meter, the unit is the kal, which is the amount of heat required to evaporate one pound of water. This charge varies from 45 cents to 80 cents per thousand kals, depending upon the customer's requirements.

"Experience in hot-water plants indicates an average consumption of coarse slack of about 55 pounds per square foot of radiating surface per season. If we assume that one square foot of surface heats 50 cubic feet, then 1,100 pounds of coal will heat 1,000 cubic feet of space, or with slightly better coal it may be said that one pound per season will heat one cubic foot of space.

"A concise statement of the advantages to the customer, and the general public, resulting from the installation of a central heating plant, may be worth making. The customer saves the expense of coal and ash handling, with their unavoidable accompaniments of dirt, dust, smoke, and soot. The saving of labor is a considerable item, particularly in large plants. The heat supply is regular, continuous, and unlimited, and is available throughout the entire night and on Sundays and holidays. The building need never become cool. The heat is capable of regulation and adjustment with fluctuations in the external temperature.

LAYING HOT WATER LINES FOR SMEAD'S CENTRAL HEATING STATION, WASHINGTON COURT HOUSE, OHIO.

Valuable space in basements and cellars is saved, there being no longer any necessity for boilers or coal storage. It is possible to have a cool cellar, which is often an advantage where it is desired to keep vegetables or provisions. Insurance rates, too, are less where there is no fire in the building.

"The service demanded of the ordinary heating boiler is so variable, and it has so little skilled attention, that its thermal efficiency is very low, rarely exceeding 50 per cent. and averaging probably not over 35 per cent. Furthermore, in order to keep fire over night, and to avoid making a smoke

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nuisance, it is almost imperative in many ordinary heating plants to burn the most expensive grade of the very best coal. In large St. Louis residences, for instance, anthracite lump of 13,000 British thermal units per pound, costing $7 to $8 per ton, is burned, with an average efficiency of 35 per cent. Under the boilers of a central heating plant, slack coal or screenings, costing $1 per ton and having a calorific value of 10,000 British thermal units, would be burned, with an average efficiency of 60 per cent. The fuel cost of the isolated plant under such conditions is ten or twelve times as great as that of the central station.

"There are advantages to the general public in central station heating in the concentration of the plant in an out-of-the-way location, in the reduction of the number of coal and ash teams on the streets, and the removal of the smoke nuisance, aside from the direct benefits obtained by those who make connection with the plant.

"There are many incidental advantages connected with the use of central station heating beyond the mere saving of fuel. This service—while in many cases a necessity—is in some instances a luxury, and it should command a price accordingly. It is worth much more to a customer than the mere amount he saves, and he should be willing, therefore, to pay the central station a rate which will enable it to earn a fair return on the necessary investment."

The plant at Washington Court House, Ohio, is designed to be practically smokeless,

LAYING HOT WATER LINES THROUGH "COURT HOUSE ALLEY" TO BUSINESS SECTION, WASHINGTON COURT HOUSE, OHIO, BY THE CENTRAL STATION HEATING CO., CINCINNATI, OHIO.

and one of the great benefits to the public at large is the removal of the cloud of smoke now arising from the many individual stoves and furnaces in the residences and business blocks of the city. Our view of the station during construction does not show the character of its architecture, but the building is quite as ornamental as the usual municipal building. The confidence of the municipal authorities in the cleanliness of the plant, and in its freedom from noise, is shown by the fact that the second story of the plant

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has been leased for the public library. The central location, in the best residence portion of the city, was another reason for this choice.

A view is shown of the court-house and jail, which are among the larger buildings to be heated from the station. Two views of the trenching for laying pipe lines are also given.

METHODS OF CLEANING PAVEMENTS.

By H. C. Innes, Hartwell, Ohio.

There are several ways in which this cleaning takes place. The first, and recognized by all cities where sheet asphalt is laid as the best means, is termed hand cleaning.

This process consists in the division of a street into sections, each of which is cleaned by one man, who is held personally responsible for the appearance and condition of the pavement in his charge. The amount of surface which one man can sweep is approximately as follows: When the asphalt is wet and muddy he can sweep about 1,000 square yards per hour; when dry, about 1,200 square yards per hour. This is about all one man can take care of, in the down town or business portion, where the travel is somewhat heavy. But in the resident district, where the travel is somewhat light, a man can keep several blocks in a very nice appearance.

In some cities, especially on a retail thoroughfare, the merchants, recognizing the benefits derived from a perfectly clean roadway, engage a man to take care of the block and each firm pays their proportion for the cleaning of the block. This has an effective result, and the cost to each firm during the month is very small, considering the benefit obtained.

Several small implements are necessary for the hand cleaning process, which are quite reasonable and can be procured anywhere. The street scraper is made of a cast-steel blade about four and one-half feet wide, six inches deep and three-eighths of an inch thick, slightly convexed, with a handle attached at the center, about five feet long. This is used principally to collect the mud and manure from the surface into a pile, near the gutter. The operator pushes it ahead of him, and being so thin it easily adjusts itself to the surface of the pavement. Any blacksmith can make this tool and the cost will not exceed $3. Two brooms will be required for sweeping, costing about seventy-five cents, a shovel or a scoop costing eighty-five cents and a wheelbarrow, the cost of which would be about $2. These are all the tools essential for keeping the roadway clean, free from dirt, dust and organic matter, and if the man is active he can keep his section in a very clean and healthy condition.

Early in the morning, when travel is light, each man should sweep a part of his section, to remove the dust which will accumulate. He should get over his section entirely at the end of the third day. The remaining part of the day he goes over hastily, collecting all refuse before it has had time to dry or be ground into dust by passing wheels. By the aid of a scoop he places this waste material into the wheel-barrow, with which he removes it to some adjacent alley and deposits it in bins or tanks supplied for the purpose. Or it could be left in small piles near the gutter, and at regular intervals removed to the city dump by the street wagons. These barrels or tanks could be made tight with a screw top, so as to permit no objectionable odor to escape. Another form for the alley tanks could be made by taking a cask, about the size of a barrel, at the center place an axle, with which the barrel could be lifted and wheeled by a truck made suitable for the purpose. This could be filled and placed in the alley, and would save one handling of the material.

The amount of sweepings taken from the asphalt pavement is not great, and by the above process all could be properly taken care of and quickly removed. In a brief time the man becomes accustomed to the work, and can by little exertion keep his section in a good condition.

The cleaning of our streets by machines is generally done at night time. These machines are all similar in construction, consisting of a platform, various levers and the revolving broom of steel wires or hickory. The broom is set at an angle of about twenty degrees, and as it revolves casts the dirt toward the gutter. The operation of cleaning the streets by machine commences with a sprinkling wagon going over the street at a rapid gait and depositing only enough water to lay the dust. Next come

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the great sweepers, two or three of them, the second about 50 feet behind the first, the third the same distance behind the second. They take one-half of the street at a time; when this half is cleaned, the sweepers return, taking the other half.

Following the sweepers is a small force of men with brooms, sweeping the dirt into piles. Then comes the ordinary dump wagon and men who load these piles of dirt into the wagon. When full the wagon takes material to the dump. These street sweepings have a great value as a fertilizer and in many instances are used extensively on farms.

Then there is another class of street sweepers which have a receptacle to receive the dirt as the revolving broom passes the material into this closed apartment. With such a machine there is no need of having a force of men to sweep by hand the dirt into a pile. This machine works almost identically like the other class of sweepers mentioned, with its platform and revolving broom, except that there is added a compartment into which the dirt is placed.

Another class of street sweepers are those which pick up the dirt by suction and place the material into a bin or receptacle, and when filled are dumped at some corner where a wagon receives the sweepings and carries them to the dump. These machines are large and require from three to four horses to pull them. They are provided with an upright boiler and fans which create the vacuum which draws the dirt into the receiver. These machines are best adapted to smooth street surfaces, and are used extensively in Indianapolis, where they are manufactured by the Pneumatic Street Cleaning and Manufacturing Co.

One of the recent applications of the electric car is to equip the car in such a manner that the motive power of the electric line can be utilized. This can be done by placing revolving brooms on the side and front of the car, projected by an arm, and place the sweepings into the gutter, or by suction pick up the dirt and deposit into a receptacle on the car. These cars could clean all the streets over which an electric car line is located, the motive power being much cheaper than horses and the work could be done more quickly.

In many cities the work of cleaning the streets is let by contract at regular lettings. In this event the contractor furnishes all tools, men, teams and machines. Some cities do their own cleaning and have their own outfit. There are many street sweeping machines of various patterns and styles and yet all similar in operation; the cost of all are about the same and all have some very good features. There are defects in almost any good device and the street sweepers are not without some. Yet the results obtained by these machines are good; they keep the thoroughfares clean, and that is a great item to be considered. They are reasonable and every city should have at least one and operate it continually. Really three machines are a set and should be found in every city having paved streets.

The usual hour for commencing this work depends largely upon the number of machines a city or contractor may have and the number of miles of paved streets to sweep. All paved thoroughfares, especially in the "down town" district, should be swept every night. In the truly residence portion the need is not so great to sweep nightly. Usually, however, sweeping does not commence before nine o'clock. Care should be taken when using a sprinkling wagon that too much water does not find its way to the pavement, as the water creates mud and when the broom revolves on the pavement it tends to plaster the mud. Upon drying it becomes dust. Merely enough water should be used so as to "lay the dust" when the machine passes over the street. Should any vehicle be standing in the gutter it should be moved out of the way so that the sweeper can go the full width of the street.

Another way in which we can clean our streets is by flushing them. This is done sometimes by attaching a hose to the fire hydrant, turning on the water and thus cleaning the street. In other words, giving it a good washing. It is not advisable, however, to wait until the street is very dirty because this filth must find its way to the sewer, and there is a chance of stopping the flow in your sewer. The street, before this is attempted, should have all the refuse taken away that is possible to remove. The flushing is merely to remove the fine silt or dust. On an asphalt street such a cleaning two or three times a week is very beneficial. After the flushing your roadway is as clean as it can be had. Another way in which flushing can be done is to have a sprinkling cart pass over the street at a very slow speed, merely moving, and the valves opened wide. The wagon should go over the street up grade. Behind the wagon a man or two could follow with the ordinary street scraper, such as is used for hand cleaning, and scrape the dirt toward the gutter and col-

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lect it in piles, which can be removed by a wagon. A good heavy broom should be used also to sweep any dirt which might remain in the gutter.

The most effectual way for flushing is by the hose, but when this can not be done the wagon process does very fairly. Flushing could be done either at night time or early in the morning, so as not to interfere with the travel. By proper cleaning of the streets at regular intervals, the dirt is removed and leaves the roadway in a condition so that at all times it can be crossed by pedestrians without soiling their dresses or muddying their shoes.

Sprinkling an asphalt street is not necessary. The roadway should be dry at all times, if possible, the dirt and dust being removed by sweeping or flushing. In doing this your thoroughfare is passed at all times and at any place. Clean streets are essential to health, and we should look to this and always keep them clean.

We have no other material for a street surface that is so easily cleaned and kept clean as a pavement laid with sheet asphalt. Such a surface requires care, as does anything. If we have an article in our homes that is pretty or which we have a fond feeling for, we most certainly take care of it, using every precaution against its becoming dilapidated or showing signs of ill usage.

An asphalt pavement is the most perfect of any of our streets, from many points of view, and when we have such a street it behooves us to take care of it and to appreciate its beauty.

Refuse or the autumn leaves should not be burned upon it, as the heat tends to soften the pavement and possibly burn the asphalt. Fires should not be made upon it and live coals from the fire engines should not be placed upon its surface. Drivers of coal oil wagons should see that the faucets of their tanks are kept closed tight so as not to permit any of the oil reaching the pavement as they pass, because oil of this kind also tends to soften the pavement. With a little care the drivers could keep oil from dripping to the roadway.

If we exercise a little care and caution in these particulars our asphalt streets will be models of perfection.

COAL TAR FOR PAVING USES.

By Fred. J. Warren, Boston, Mass.

Coal tar is a generic term applied to those bitumens which are extracted from coal by various processes in the manufacture of gas and coke. Commercially the name is improperly applied to water gas tar. The nature of the tar varies as does the nature of the coal, and also varies with the processes employed in the manufacture of the gas or coke. The process of collecting the tar is to pass through a cold water bath all of the vapors produced by distillation and which come off the coal and the other materials used. The gas rises to the top of the water, a large part of the ammonia is carried off in solution in the water and the tar is condensed by the water and settles to the bottom of the water bath.

There is no known method of describing accurately the true condition of tars. It is proper to say that no two tars are identical in every respect, although many tars are identical in every essential respect. Variations also occur from the admixture with the coal in the process of distillation of greater or less quantities of oils of various classes used for the purpose of enriching the gas. The tars vary in the amount of bitumen which they contain within the limits of 60 and 92 per cent. They also vary largely in the percentage of oil which they contain and in the quality of the oil. The non-bituminous matter contained in the tar is generally carbon, which is synonymous with lamp black, and was, of course, hydro-carbon before hydrogen was eliminated by combustion. The carbon is insoluble in carbon bisulphide or in the lighter coal tar oils, while all of the bitumen is soluble in coal tar, benzine or naptha. Petroleum light oils or carbon bisulphide does not furnish a perfect solvent for coal tar bitumen. The process of determining the amount of bitumen in a tar is to liquefy it further by the use of coal tar benzole and all of the solution will pass through the filter paper except the carbon. About 2 per cent. of the carbon is so fine that it will go through the filter paper and will appear by this test as bitumen.

The study of the by-products of tar is a very interesting one, but is too voluminous to be touched upon in an article like this, which has more largely to do with cements or pitches manufactured from tar for use in the making of concretes.

Coal tar cement is a residue by distillation of coal tar. Hardness is produced in coal

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tar cements, as in other bituminous substances, by removing part of the oils contained in the bitumen, leaving the residue of the consistency desired. Flexibility is maintained by sacrificing a certain amount of the hardness. To make a cement or pitch of a given consistency, say the equal of asphalt cement at 78 degrees F., or a standard asphalt paving cement, requires the removal in one case of 16 per cent. of the original oil, and in another as high as 52 per cent. The natures of the oils removed vary as greatly as do the natures of the residues left. One per cent. of oil taken from one tar will produce more hardening effect on the residue than will 1½ per cent. taken from another. The quantity of oil removed at any given temperature from various tars varies greatly. Using an inferior tar, a pitch or cement can be produced by distilling off the oil at a temperature of 200 degrees, while using the most permanent tar in practical distillation requires a temperature of about 600 degrees. The temperature at which coal tar cements can be produced can be reduced greatly by supplementing distillation by mechanical agitation or by blowing super-heated steam or hot air into the still. The character of the residue or cement left by distillation depends somewhat upon the process employed, even when dealing with a given tar.

With the above synopsis of what coal tar pitch or cement is, I would say that coal tar was, up to 1845, the waste product of the gas-works. The process of making gas at that time was crude, and the coals used were of a more uniform grade than those used at the present time. Tar was first used in its crude state as a supposed adulterant of pine tar pitch, which was then used to a very limited extent for roofing. This use developed that the more coal tar bitumen was used the better was the roofing material. The development from 1845 to 1865 was almost entirely in building composition roofs, and for this purpose it was not realized that any great care was necessary in the selection or preparation of the material. Notwithstanding the imperfect methods adopted, the industry has grown to immense proportions, and the roofing industry furnishes by far the largest market for all of the coal tar products of the country, amounting to over five hundred million pounds per year, and giving employment to about fifty thousand men. It has therefore not seemed necessary to the manufacturers of coal tar goods to adopt any of those methods in the preparation of their cements which have been so essential to the proper use of the asphalt bitumens, when applied to the building of concrete or asphalt pavements.

While vast sums of money have been spent in chemical research on the use of more than two thousand by-products of tar, it is a sad commentary upon the manufacturers of tar cements that there is not one large established concern in the United States which maintains an efficient or modern laboratory, which alone will enable them to put on the market an even approximately uniform bituminous cement. In the sixties an effort was made to imitate the asphalt mastics of Europe by producing an artificial asphalt mixture using the coal tar cements to bind the particles of sand together. It should be borne in mind that all classes of concrete, whether asphalt cement, coal tar cement, or hydraulic cement is used as a binding material, are in fact artificial stones. The durability of the work depends upon the selection of the cement as well as upon the selection of the mineral aggregates, whether sand or stone, and upon the skill and care displayed in mixing and laying. The cement is used to bind the particles of mineral matter together. The skill and experience displayed in the selecting of the cementing material and the selection of the mineral matter has much to do with the durability of the work. Unfortunately, those engaged in the building of tar concrete sidewalks had not given the matter much, if any, scientific consideration, and at the time the tar bitumens were extensively used no one had any accurate knowledge of the proper selection of the mineral aggregates. This condition, combined with the fact that no one engaged in the business carefully prepared the bituminous cements, led to disastrous failures in a very large proportion of all the bituminous concretes put on the market. It should be noted, however, that the same methods, when asphalt was first used, led to almost equally disastrous results.

To what extent the tar bitumens are available for use in concrete structural work the writer is not yet prepared to say, but a few facts can be recorded. There are a few cases which exist to-day which show conclusively that when at their best tar concretes have developed a life greater than the longest life of any piece of asphalt work in this country under any condition of usage. This is because asphalt pavements, or concretes, have not been in use as long as the best tar concretes, but the writer has no doubt but that a properly selected asphalt bituminous cement will under most conditions of usage

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develop a greater life than can be developed out of the best coal tar cement under exactly similar usage. Asphalt is as generic a term as coal tar, and the name can be properly given to any natural bitumen of a gummy nature as found in nature, whether it be admixed with mineral matter of various classes, or is found in a relatively pure state. The nature of the bitumen found in the asphalts combined with mineral matter is as various as is the nature of the bitumen found in the tars, and experience and development have demonstrated the necessity of great care in the proper building of asphalt concretes or pavements. When the same methods which are found necessary in the building of asphalt concretes are employed in the selection of the tars and in their preparation, it is possible to produce cements of as great uniformity as it is possible to produce when using the asphalts.

Tar cements as a class have the following advantages over asphalt cements as a class:

1st, greater adhesiveness,

2d, greater waterproofing qualities,

3d, greater ductility.

The best coal-tar cements are inferior to the best asphalt cements in the following qualities:

1st, All of the oils contained in coal-tar cements can be evaporated at relatively lower degrees of temperature, and are, therefore, shorter lived as affected by the sun.

2d, The best coal-tar cement contains a shorter range of flexibility under atmospheric conditions than does the best asphalt cement.

While the above is true of the coal tars as a class, it is equally true that the best quality of tar can produce a cement for certain classes of concrete uses which is superior to the average grade of natural asphalt cement, and this is especially true as applied to the building of bituminous concrete sidewalks and of bituminous macadamized roads. In sidewalk work the writer knows of one piece of pavement which has been in satisfactory use for over forty-two years, the bituminous material of which is coal-tar bitumen, and he knows several isolated cases where the sidewalk has been in use for twenty-five years.

Coal tar will never displace the use of asphalt, for any advancement which takes place in the use of coal tar will also take place in the use of asphalt. The coal tars under a proper system of development are bound to furnish to the trade the cheapest cement available, and one which, if carefully handled, will produce concretes suitable for many uses, and which will last from twenty to thirty years. It will produce the cheapest good concrete which can be produced, but it is not possible of development to such an extent that it will produce a mastic which will stand intact for centuries. This is true of the asphalts, specimens of which are recorded as being found in the ruins of Babylon and the Tower of Babel twenty centuries after their construction.

The modern method of examining the bituminous material is to collect specimens of concrete which have shown long life, extract the bituminous matter and determine the percentage of bitumen and the temper as recorded by penetration machine and then separate the mineral aggregate into the various sizes of material. By carefully noting the conditions which exist in each specimen examined, and by examining a large number of specimens, a reasonably accurate conclusion can be drawn by a man of sufficient experience to enable him, with reasonable certainty, to duplicate the condition which he finds invariably exists in those particular specimens which have developed the greatest life.

A careful examination of the oils produced by distillation shows a relatively greater difference in their physical and chemical characteristics. An examination of the residues produced with a view to developing their physical characteristics develops fully as great differences in the quality of the residues as exists in the quality, quantity and amount of volatile matter of the oils. But the writer would prefer to touch on the physical differences of the cements at another time.

AMERICAN PORTLAND CEMENTS.*

By S. B. Newberry, Sandusky, Ohio.

I esteem it a great privilege to come before you to present the claims of one of America's new and great industries, and one which in the last ten years has developed at a more rapid rate than any other branch of manufacture. Ten years ago

*A paper read before the Indiana Engineers' Society, 1901.

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American Portland cement was practically unknown, and nearly nine-tenths of the Portland cement used was imported from Europe. To-day the consumption of this material has increased more than four-fold, and more than 75 per cent. of the total, over 7,500,000 barrels yearly, is the product of American mills. Portland cement is now made at fifty factories in this country, representing an invested capital of over twenty million dollars, and the value of the annual product is not less than ten million dollars.

An industry which has developed in ten years from a production of 400,000 to 7,500,000 barrels is certainly a healthy and substantial one, and a brief study of the manner in which American engineers have solved the chemical and mechanical problems of adapting this branch of manufacture to American conditions can not fail to be of interest.

Portland cement derives its name from the resemblance in color of the hardened cement to the Portland stone, quarried in England. It is, therefore, a name which represents a *quality*, not a locality. The same material may be made in any country in the world, provided deposits of carbonate of lime (limestone or marl) and a suitable clay are available. In England, chalk and clay have been used for Portland cement manufacture since 1828. Later, the Germans established the industry, using limestone, marl and clay, and took such pains with the process that they greatly improved the product, and German Portland cement became the standard all over the world. Attempts to produce Portland cement in this country were made in 1873 near Kalamazoo, Mich.; the first successful efforts were those of the late Mr. D. O. Saylor, at Coplay, Pa., in 1878. In the latter vicinity occur inexhaustible deposits of clay limestone, approaching a correct cement mixture in composition, and this region has become the chief seat of the industry in the United States.

Now, a few words on the materials and process, in order that the difference between American and European practice may be understood.

Portland cement is made by calcining at a nearly white heat an intimate mixture of carbonate of lime and suitable clay, in exactly correct proportions, and grinding the resulting clinker to powder. The carbonate of lime may be chalk, limestone or marl. Limestone, unless it already contains nearly the amount of clay required, is an unfavorable material, owing to the high cost of grinding to the great fineness necessary to secure a perfect mixture with the clay. Even in the case of the clay limestone found in the Lehigh Valley region, the different strata must be selected and ground together in such proportion as to yield a mixture varying not more than one-half per cent. from the correct standard.

In Europe, the burning has been done in vertical intermittent or continuous kilns, similar to lime-kilns, and this method was originally used in the United States. The use of these kilns necessitates molding and drying the raw mixture in the form of bricks, before burning, an operation which involves much handling and greatly increases the cost of the process. In 1885, Ransome, in England, patented a revolving kiln, fired by gas, into which the cement mixture was to be fed continuously in the form of powder at the upper end, and discharged at the lower end in the form of clinker. Ransome's kiln was a very small one; the results obtained were not satisfactory, and the experiment was soon abandoned. Perceiving the possibilities of the new kiln in saving of labor, and its consequent especial value in the United States, Mr. Navarro, of New York, began in 1888 to manufacture cement at Coplay, Pa., by the Ransome process. Many difficulties were encountered and a large amount of capital was expended, but success was finally attained, especially after the substitution of crude oil for gas as fuel. About the same time, Mr. Duryee, at Montezuma, N. Y., and the Warner's Cement Company, near Syracuse, made the further advance of introducing the raw material in the form of wet slurry at the upper end of the kiln.

As the rotary process became better understood it was found that the short burning and quick cooling yields a much better cement than that obtained from the old-fashioned kilns. The use of the rotary kiln rapidly extended, and at present over 80 per cent. of the American product is burned in this apparatus. The advance in price of crude oil necessitated the use of some other fuel, and coal, ground to fine powder, and blown into the kiln by a blast of air, was found to be an effective substitute.

The accompanying diagram shows the production, importation and total consumption of Portland cement in the United States from 1890 to 1900. You will note that the production has increased nearly twenty-fold, while the imports have remained nearly constant. The total amount of Portland cement consumed, the sum of the domestic

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product and the imports, has increased four-fold since 1890. In 1891, 13.2 per cent. of the cement used was American manufacture; in 1896, 35 per cent.; in 1898, 65 per cent.; in 1899, 74 per cent., and in 1900, nearly 80 per cent.

The points which appear most strikingly in the diagram are:

1. The wonderful growth of the manufacture of Portland cement in this country.

2. The surprising increase in the use of Portland cement, showing how rapidly it is

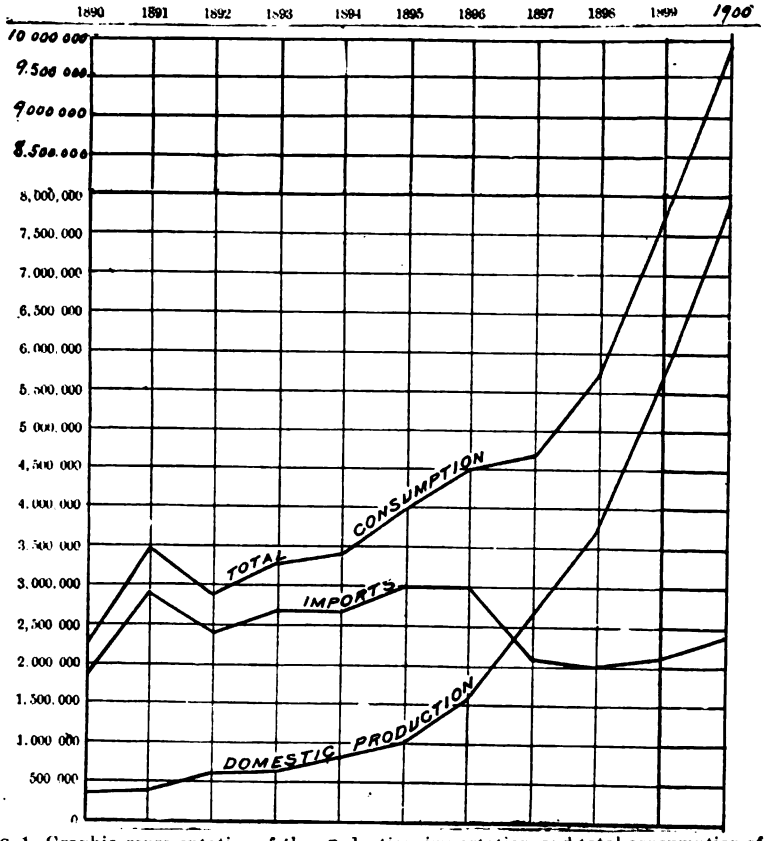

FIG. 1—Graphic representation of the production, importation, and total consumption of Portland cement in the United States from 1890.

being adopted in place of masonry or the natural hydraulic cements.

3. The nearly constant imports, showing either that the domestic product has been insufficient to supply the demand, or that a certain class of consumers still have a prejudice in favor of imported brands.

The chief cause of the rapid growth of the Portland cement industry in the United States is undoubtedly the development of the rotary kiln process of burning. The old method of burning in vertical kilns involves the molding of the raw material into bricks, placing on wagons, drying in tunnels and charging into the kiln with alternate layers of coal or coke. These operations involve a large amount of labor and a considerable cost for fuel in drying. In the rotary process, on the other hand, the material is introduced into the kiln at the upper end in the form of dust or liquid slurry, and issues from the kiln continuously as burned clinker. The expense of drying, charging and emptying the kiln is therefore entirely saved.

Again, the output of the old-fashioned kilns is very small: that of the intermittent kiln does not exceed 90 barrels every five days, and that of the continuous vertical kiln 80 barrels per day. By the rotary process a regular output of 150 to 175 barrels per day is obtained. Further, the first cost of a rotary plant for a given output is not more than one-half that of a plant

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equipped with the old-fashioned kilns. It will be readily seen, therefore, that the rotary process is especially adapted to American conditions, on account of the high cost of labor in this country.

Another cause of progress in the industry in the United States is the widespread occurrence of deposits of excellent cement material. As already stated, inexhaustible beds of clay limestone occur in the Lehigh Valley region; and in the central portion of the country large deposits of marl and suitable clay are found.

In respect to quality, the product of the rotary kilns is certainly superior to that obtained by the old process. It is found that the quick burning and quick cooling of the rotary process, and also the far less contamination by ashes of the fuel, result in the production of cement of remarkable hardening properties, while the long and uncertain burning of the old-fashioned kilns destroys these properties to a considerable extent. In the old process a large portion of the clinker obtained falls to dust in cooling, and this dust has practically no hydraulic properties; the clinker contains much over and under burned material, and must be sorted by hand or an inferior product will result. The rotary clinker, on the other hand, is uniformly burned and free from inert material of any kind.

As to the quality of the Portland cement produced at the leading American factories, I may say that tensile strengths of 600 pounds in seven days and 800 pounds in twenty-eight days, and with three parts sand, 250 pounds in seven days and 300 pounds in twenty-eight days, are the rule. Our leading manufacturers can safely guarantee these results, which are far higher than those yielded by the best brands of imported Portland cement. The German official requirements call for 227 pounds, with three parts sand, in twenty-eight days. Many of the best German cements sent to this country will fall short of this figure.

American Portland cements have been criticised by some engineers on account of the extremely high neat tests shown at short periods. I have, however, found this quality characteristic of all cements made from extremely finely-ground raw material, and quickly burned and cooled. Although our best cements may gain nearly their maximum strength at twenty-eight days, and may show comparatively little increase thereafter, the sand test will be found to show a steady gain for several years.

Another safe-guard of the best American Portland cements is to be found in the regular use of the *boiling test* by our manufacturers. This test has been declared too severe by the German Association of Portland Cement Manufacturers, and is not recognized in the German official requirements.

Still another advantage in the use of American Portland cement is the readiness of the leading American manufacturers to give substantial guarantees of all work done with their product under the supervision of a competent engineer. Such guarantees can not, of course, be obtained in the case of imported cements.

Those who doubt my statement that the leading American Portland cements show much higher tests than the imported, need only to consult the reports of the mayor of Philadelphia for 1896-97. These reports contain the results obtained by Mr. Richard L. Humphrey, inspector of cements, and show the average strengths obtained with all American, German, English and Belgian cements tested in each year. Graphic tables are given, showing that the average of the American cements, both neat and with sand, is far higher than those obtained with the foreign cements. These tests, and many others made by unprejudiced engineers, warrant the statement that there is, at present, no Portland cement made anywhere in the world which is equal in quality to the product of the leading American factories.

Profiting by the success of American engineers in perfecting the rotary process, foreign manufacturers are now rapidly introducing this method into Europe. Rotary kilns have within the past two years been installed in England, France and Germany, and are operating with great success. The report of the German Cement Makers' Association for 1900 states that at Hemmoor, in Germany, the cement obtained was of higher quality than that yielded by the vertical kilns, and that a saving in cost amounting to eleven cents per barrel had already been attained.

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EDITORIAL COMMENT.

American Cement Manufacture.

The study of the methods of manufacture of cement now in use in America and under process of development, demonstrates again the adaptability of the mechanical engineers of this country and their ability to develop what are practically new methods from hints supplied by others, and to invent new processes for special application under the mechanical, social and financial conditions here. Thus the Ransome rotary kiln was a failure in England for cement work, but American engineers, seeing the possibility of success, expended a large amount of money and time in experimenting, breaking away from established methods whenever it seemed desirable, without fear of consequences. The result is a practical revolution in the methods of Portland cement manufacture, and the advance of America to the fore-front in quality of product, in cheapness, and within a very few years more, in quantity manufactured.

The rotary kiln is now being introduced in Germany with equal success, and material reduction in cost of manufacture. It is under experiment in England but on such conservative lines that its success is not yet fully assured.

A number of grinding machines have been developed for various purposes in this country. Their manufacturers in looking for business find that the cement factories have large use for machines which will grind hard material to a uniform and extreme fineness. They immediately proceed to adapt their machines to this material and enter into successful competition with the stone mill borrowed from the flour mill, and with the mills invented especially for the grinding of cement. The Griffin and Kent mills, the Narod pulverizer, are American inventions which make any desired fineness of product capable of attainment.

In the preparation of the "Directory of American Cement Industries and Hand-Book for Cement Users," it has been most interesting to observe this promptness of the American manufacturer and business man to take hold of a new idea, to develop a new field. A suggestion to a manufacturer that he has machinery or apparatus which can be used in the cement mills which are now springing up so rapidly, or to replace older machines in established plants, sets him to studying the new processes and to demonstrating the adaptation of his particular machine to the work required. It takes but little encouragement to start him to rebuilding a machine to make it fit exactly the new conditions.

A warning note must be sounded in the midst of this rapid development, one which will probably not be heard in the hurry of the advance, but one which is already too late for some who have failed to study all the details carefully before investing their capital. This warning is not at this time against the rapid multiplication of cement plants, though this is marvelous, for the rapidity of development in the use of cement is even more rapid than the increase in manufacturing capacity, and as the price of good cement is reduced by the competition of the many makers, the use of cement will increase still more rapidly, so that the prospect of a glut of the market is at present very remote. The warning is rather against haste in deciding upon a material newly discovered and the construction of a plant where the supply of material is limited or its quality has been misjudged. Under former conditions, and to a large extent under present conditions, such an error could be corrected, for proper materials could be sought for and found, and then shipped at some additional expense to the mill already constructed, the extra cost reducing the profits but slightly. In the future, however, when the question of profits will depend upon the economy of the manufacturing operations, this extra transportation charge, with the attendant items, may make the difference between some profit and none, or a positive loss. This exercise of poor judgment, or rather exercise of judgment upon insufficient data, on account of too rapid survey of the prospects, has been observed in some cases. Formerly, with small and comparatively cheap plants, they could be removed without serious difficulty, but the modern competition demands a plant with a capacity of several hundred barrels a day, one that is practically immovable.

The directory will be ready for delivery in April, and will show what plants are now ready for work, with most of those which will begin manufacture during 1901, giving sufficient description of practically all of them to show their size and facilities for turning out a good and uniform product. This is possible because the managers of the plants have seen the advantage of the appearance of this information in such a book as is under preparation, and very few have refused the information desired, from motives of business caution or otherwise. With the chapters on the development of the cement industry (introductory), on the uses of cement and on descriptions of works, and the directory of companies with their officers, sales agents, and brands, the infor-

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mation upon the present state of the Portland cement industry in this country is practically complete. Nor is natural hydraulic cement neglected, the principal manufacturers being well represented, though no serious attempt to list every factory in existence has been made.

Standard Specifications for Brick Pavements.

The National Brick Manufacturers' Association has long had a standard system of tests for paving brick and has adopted programs for such tests, which are now again under consideration by its committee. This committee states that it will not be ready with the report proposing some modifications of the present requirements until June, 1901.

The related question as to the proper method of construction of brick streets has also interested the association, and its committee upon this subject has just made a report, the text of which will be found on another page in this number. It will be seen that the committee makes very few recommendations, and that the various uses to which brick pavements are put have their effect in varying the construction proposed. For cities with heavier traffic the construction proposed will secure the best brick street possible under usual conditions. The modifications proposed for small towns and for country roads are in the line of cheaper construction, which, under the comparatively easy conditions of such towns and roads will secure satisfactory pavements at a cost which will permit the construction of many miles of pavement out of reach of the residence property owners of small cities and towns, if first-class construction were insisted upon.

A very important part of the specifications for a brick street lies between the fields of the two committees. The joint committee of the N. B. M. A. and the A. S. M. I. should, however, consider it and include it in any recommendations of forms of specification. This is the standard of quality of brick for given duty. The committee on tests proposes a program of tests but is careful not to say how the results of these tests shall be applied in accepting or rejecting brick for a given street. The committee on construction suggests general requirements for the process of building streets, and is also careful not to say anything about the quality of brick to be used.

In a general view, the quality of brick seems to be of first importance, but practically the character of foundation is first, as the kinds of brick to be used are in practice limited to hard-burned brick made from certain kinds of clay or shale. Quality is a close second, in any event, and standards of quality can not be omitted from a standard specification.

The fixing of standards for various duties to which brick are subject is even more difficult than the fixing of standard methods of construction, in which the committee is so diffident, for the quality of brick to be used with true economy depends upon the same conditions as the method of construction, and also upon methods of construction adopted. It is, therefore, practically impossible to fix absolute rules for quality of brick, and any recommendations would doubtless be as indefinite as those of the present committee report. If they are equally valuable, however, they will be a safe guide to the inexperienced engineer and municipal official, and will materially raise the standard of construction, especially in the smaller places.

It is comparatively easy to fix the standards for the highest quality of construction and material, but such construction is only necessary in cities of such size that enough expert aid can be secured to make the specifications adequate. What the joint committee needs to do in particular is to formulate a series of recommendations for the cheaper grades of construction economically necessary under the conditions in small cities, towns or villages and country districts. The ordinary councilman or trustee having these matters in charge is not able to fix upon the construction which true economy demands in his case. He knows that his constituents can not afford the best construction, and he has no guide but some hazy notions of cheaper constructions obtained from observation or from reports usually of interested or biased persons, seldom with expert knowledge. While the committee can not solve in advance all the problems arising for all the councilmen, it can lay down some economic principles upon which the selection of quality of brick and method of construction of pavement should be based, and thus help them to better solutions of their problems than they are now able to make. If it succeeds by its report in convincing a councilman that he needs expert assistance in solving his particular problem it has fully justified its appointment.

The membership of the committees, so far as known, guarantees a conservative report which will be in accord with the best practice and will pay proper attention to

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the economic side of the question, a most important element in all successful plans for engineering work.

State Supervision of Municipal Accounts.

In 1896, the Province of Ontario created the office of provincial municipal auditor, whose duty it is to examine the account books of any public official, to make recommendations of changes in methods which are desirable, and to report to the proper authorities deficits, errors and other results of such examinations. The report of the office for the year 1900 is at hand, and demonstrates the value of the office. In this one year about $6,000 has been saved to the municipalities whose books have been examined, poor methods of bookkeeping, and possibly in some cases a little dishonesty, havign been responsible for deficits amounting to this sum, which would not have been discovered but for the official examination. These amounts were recovered, being paid without question by the treasurers involved. The books of 122 public offices were examined during the year. Many peculiar methods of keeping accounts and taking care of money are reported. The office does not seem to have power to enforce its recommendations directly, but the regular channels for taking care of deficits are open, and public opinion can be depended upon to improve methods which are not adequate to the business done, when they are reported upon officially.

The effect of the office upon municipal accountants is shown by the statement that in 1897 the department discovered losses of about $100,000 which were not recovered, in 1898 about $11,000, in 1899 about $4,000, and in 1900 nothing, all reported deficits having been made good.

This is an object lesson which should have its effect in aiding the movement toward uniform municipal accounting and the project for state supervision of accounts which is taking a prominent position in the discussion.

New York State Canals.

The report of Mr. Edward A. Bond, New York state engineer, on the proposed barge canal from the Hudson river to the Great Lakes, made to the governor February 12, has just been issued. It was made in obedience to an act passed in April, 1900, and with the assistance of many engineers familiar with the former work on the canals and with the work of the deep water-ways commission of the United States government, and with the advice of an advisory board composed of the most eminent engineers in the country in this class of work. The exact program for the investigation was laid down in the act, and is followed almost without exception.

While the report may be subject to some criticism from the shortness of the time allowed for the investigation, this objection has less effect than it would if there had not been so many exhaustive studies of many of the parts of the problem, the results of which need only to be combined to furnish almost complete data for the present report.

The several alternative routes are divided into convenient sections, varying from 0.65 mile to 71 miles, each of which is carefully estimated. These sections are then combined to form the various routes. Additions are made for extra expense if the work is all done in winter, and deductions are made for abandoned lands to be sold. The resulting routes for the main canal from Troy to Buffalo vary in cost from $46,765,755, via Oswego and Olcott, to $81,578,854, via the present canal route, with some modifications. With the cost of the proposed improvements of the Oswego and the Champlain canals added, the latter figure becomes $87,317,570. This is $25,000,000 more than the estimate made by the committee on canals appointed by Governor Roosevelt in 1899. The increase is due to an increase in proposed dimensions of the Erie canal, increases in estimates of quantities of work to be done on account of more detailed information now available, necessary additional water supply, and other items due to the more hurried report of the former commission and its lack of reliable data on which to base estimates.

A report made by Mr. Bond on February 20, at the request of Governor Odell, submits estimates made by the division engineers on the Erie canal of the amounts necessary to complete the famous $9,000,000 canal, which was left partly done when that sum was exhausted. These estimates amount to $14,973,323 for the Erie canal proper, and $19,797,828 for the Erie, Champlain and Oswego canals, or more than twice the amount already spent. Some opinions are also presented tending to show the limitations of the canal, if completed on these plans, and the probable economy of the larger canal now proposed.

The decisions of the legislature and of the people upon these questions will be awaited with interest. The problems are large, and the new water-way will probably have considerable influence over transporta-

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tion conditions throughout the country, no matter which is selected, though there are many indications that the smaller canal will have comparatively small effect. Success here would increase the feeling in favor of extending the Chicago drainage canal for navigation purposes, and would give rise to many similar projects. Failure would probably settle the question of artificial water-ways for an indefinite period. What New York or the United States government spends here will not be quite thrown away, therefore, even if the expectations of the promoters of the large canal are not fulfilled.

ANSWERS TO QUESTIONS.

RELATION OF METER AND FLAT RATES.

Replying to your correspondent from Kaslo, B. C., in your March number, regarding the introduction of water meters in his town and the comparison of the old flat and fixture rates with the meter rate about to be established, I would say that it has come under my observation that all former rates should be eliminated in justice to the small consumer. He is the one who, as a rule, makes most complaint, and it is seldom he does so without a good reason, but he is seldom thought of until he comes to pay his bill, and then he is told he is getting "fair treatment," much to his surprise.

If your correspondent has a large number of small consumers, which I presume he has, their wants should be taken as a basis for establishing a meter rate. In looking over some notes made recently in regard to the consumption of water in various lines of business, I find that without exception they all come under what is called the "minimum rate," which amounts to 20,800 gallons per year. This includes blacksmith shops, barber shops, small bakeries, butcher shops, and so on down the list. The average family of five persons, with bath tub, closet, wash tubs, kitchen boiler, and in some cases a small garden, all come under this rate, and all are satisfied with the amount of their water bills.

To charge all of the separate classes of consumers a different rate would lead to a vast amount of figuring when the time came to render the bills, and when the expenses were figured it would show a balance on the wrong side of the ledger; consequently, for this reason alone, it would not be advisable to establish a meter rate similar to the old flat rates, when the differences are what it is really necessary to be entirely rid of in order to make the department a success.

The consumption of water by the manufactories is not to be lightly considered. If they were only charged a slight advance on the actual cost of the water it would be an advantage to have their patronage in a great many ways.

The establishment of a low meter rate with a minimum rate will develop results that will possibly surprise your correspondent, and I would advise him not to consider the old flat rates as a basis of the new meter rates.

Benjamin L. Williams, Jr.,
West Orange, N. J.

CONCRETE PIPE AND ARCHES.

Can you refer me to any articles, or give me any information on concrete pipe and its use for water and sewers; also any books on Melan arch or similar construction?

R. W. Farley,
City Engineer, Hull, P. Q.

A concrete sewer on piles is described by Eugene Lentilhon in the Transactions of the American Society of Civil Engineers for June, 1894. The details of the Ransome system can be obtained by addressing Ransome and Smith, 19 Ninth street, Brooklyn, N. Y. Latham, Adams and Folwell give more or less upon the subject in their books upon "Sewerage." The specifications for cement sewer pipe in use in Brooklyn can be obtained from the department of public works, superintendent of sewers. "The Directory of American Cement Industries" contains full specifications for Melan arch construction, and for most other uses of concrete. It will be ready for delivery in April. The Melan arch bridges in Indianapolis are described in MUNICIPAL ENGINEERING for February, 1901.

SINGLE-RING BRICK SEWERS.

Will you kindly inform me how large it is safe to build single-ring brick sewers, giving instances where they have been built? *H. M. M.*

The usual practice is to build sewers with a single ring if circular up to a diameter of three feet, if the soil is good. In bad ground two rings should be used, even for the smaller sizes. Single-ring sewers can not

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be made certainly water tight, and where leakage from or into the sewer is objectionable double rings should be used. Sewers have been built with single ring in good ground, of five feet diameter, with fair success, but they do not withstand wear satisfactorily and require thorough repair or reconstruction in a few years, whereas double or triple-ring sewers would last indefinitely. South Bend, Ind., has such a sewer.

COST OF STREET CLEANING.

We wish information on the cost of street cleaning. Have you published a tabulated statement for various kinds of pavement in the principal cities of the United States?

Home Construction Company,
Lexington, Ky.

On page 384, June, 1899, a number of statements of prices at which work was let in various cities are given for both street cleaning and sprinkling. On page 201, March, 1900, is a table prepared by Andrew Rosewater, M. Am. Soc. C. E., city engineer of Omaha, giving the total cost of street cleaning, the average cost per mile and the scale of wages paid in forty American cities for 1898, and the estimated cost for 1899. An editorial discussion appears on page 254, April, 1900. Under the heading of "Garbage Disposal, Street Cleaning and Sprinkling," in the department of "Improvement and Contracting News," will be found from month to month the statements of prices at which contracts are let for the next season's work.

BRICK GUTTERS, CROSSINGS AND PAVING.

I would like to have some information about putting down brick gutters and brick crossings; also about brick paving.

The paper on "Modern Brick Pavement Construction," in this number, gives good modern practice in laying such pavements. While the construction recommended is that which will give the best satisfaction, it is true that a cheaper pavement is more satisfactory than none, and some pavements which give good results under light travel have been laid with well compacted gravel foundation or even with two courses of brick. A well drained subsoil of firm materials greatly aids in cheapening the construction of pavements.

The method of putting in the foundation for the concrete curb and gutter, recommended in the paper, is equally good for a brick gutter. If the remainder of the street is entirely unimproved, the gravel or stone foundation should be somewhat wider than the brick gutter and rise to the surface outside to prevent cutting down the gutter by heavy wheels when the street is very muddy. For macadam or other improved street the construction proposed is sufficient.

For street crossings a similar construction can be made, but the depth of foundation should be twelve inches or more, a heavy crown should be given to the crossing, the foundation should be carried outside the brick, and the brick itself should extend somewhat beyond the line within which the crossing is to be kept clean. This is so that in time of deep mud the heavy teams can mount the crossing without striking the edge of the brick paving, with the consequent breakage and dislocation of pavement. If the street is well macadamized or otherwise improved this extension of the foundation is not so necessary.

OIL FOR LAYING DUST.

We are very much bothered with dust, and as water is a scarce article and constant sprinkling is necessary, the question of using oil is under consideration. We would appreciate any information on the subject of how much is required for a certain area, how often it is necessary to sprinkle, and the features that are objectionable. Our oil will cost us about 4½ cents a gallon.

Alamogordo Improvement Company,
Alamogordo, N. M.

A good article on the use of oil for roads will be found in MUNICIPAL ENGINEERING MAGAZINE for January, 1901. A report on the use of oil strictly for laying dust will be found in this number. It was made by A. E. Brock, trustee of the city of Redlands, Cal. Further information will be found in the number for July, 1900, and the report of an unsuccessful experiment by the Massachusetts highway commission on page 332 of the number for May, 1900.

WATER REQUIRED FOR LAYING MACADAM PAVEMENT AND CEMENT WALKS.

What is the average quantity of water required in the construction of a square yard of macadam pavement, and what in the construction of a square yard of cement walks? ——. *Windsor, Ont.*

The character of the specification determines the amount of water required for a macadam pavement. It may range from say that required for cement walks to four or five times this amount. Many macadam pavements have been successfully laid without the use of water.

Computing a cement walk at four inches depth, and using the theoretical proportions of water in the mortar, including the amount necessary for wetting stone, the use of water may easily reach 30 gallons a square yard. This allows a little for excess of moisture. Any water used in moistening the foundation for packing it under roller

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or tamper should be added to this. The amount used in practice may be somewhat more than this on account of waste and water used for washing and cleaning boards and tools, etc.

DATA ON ELECTRIC LIGHT PLANTS.

Where can I find data on the ownership and operation of municipal electric incandescent lighting plants where they sell current to the public, and the rates charged?

E. S. Harlow, Washington, D. C.

The recent report by Carroll D. Wright, United States commissioner of labor, is the fullest and most reliable collection of such data. The plants are anonymous in the report, but the data, so far as the question is concerned, are perhaps just as valuable. Regarding street lighting, a summary of this report appears in the report of the proceedings of the 1900 meeting of the American Society of Municipal Improvements. There is also a valuable report in the same line in the proceedings for 1899. D. L. Fulton, secretary, Allegheny, Pa.

MUNICIPAL MATTERS IN COURT.

Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.

Validity of Bid for Paving.—A bid for a street-paving contract was not invalid because the price bid was written over an erasure without any note being made of such erasure, where the bidder made affidavit that the erasure was made before the bid was verified or submitted. In re Clamp et al., 68 N. Y. Supp. 345.

Building Line.—Where a building line on a certain street was established by a common council under authority of the charter, and no appeal was taken therefrom by any of the property owners, but the same was recognized by the inhabitants as valid for ten years, a presumption arises that the line was properly established. State, ex rel. Berger, v. Hurley et al., 48 At. Rep. (Conn.) 215.

Step in Sidewalk.—The building by a city of a sidewalk with a step which, from the nature of the grade, the city government deems necessary and proper, is not such negligence as will warrant a recovery against the city by one injured in a fall caused by the step, unless the plan of construction adopted was manifestly unsafe. Teager v. City of Flemingsburg, 60 S. W. Rep. (Ky.) 718.

Removal of Snow and Ice from Sidewalks.—Where a city ordinance requires that all snow and ice shall be removed from sidewalks within four hours after falling, such ordinance presupposes the duty of the city to keep the sidewalks in a reasonably safe condition for public travel; and a neglect of that duty, resulting in injury to an individual, carries with it a right of action. O'Hara v. City of Brooklyn, 68 N. Y. Supp. 210.

Diversion from Specifications.—Where the original specifications required a sewer to run under the wide embankment of a railroad, and a diversion was arranged between the township engineer and the contractor by which the sewer was run under a bridge near by, thus saving the contractor a considerable sum of money, the township was entitled to no credit on account with the contractor for such saving, in the absence of a stipulation to that effect when the diversion was allowed. Inhabitants of Cranford Tp. v. Watters, 48 At. Rep. (N. J.) 317.

Discretion of City Engineers.—Baltimore City Ordinance No. 50, of 1900, authorizing the repaving of a street, and declaring that the paving shall be done with asphalt, but permitting the use of vitrified brick in lieu of asphalt in the gutters and on such other portions of the street as, in the judgment of the city engineer, shall be necessary, is not invalid as delegating to him the power belonging to the city council to determine what material shall be used. Mayor, etc., of City of Baltimore v. Stewart et al., 48 At. Rep. (Md.) 165.

Contract with Promoter.—A contract between a promoter and a pavement company whereby the former undertakes to secure the consent to introducing, extending, and securing the use of the pavement in a city, and to "use and make all reasonable, honest and lawful efforts to secure the right from the city * * * to make bids for laying such pavement or paving blocks on the streets of the city," is not void on its face, as being against public policy. Dunham v. Hastings Pavement Co., 68 N. Y. Supp. 221.

Engineer's Certificate.—In mandamus proceedings to compel the comptroller of New York City to draw his warrant in payment of a sum due relator, a public contractor, under a contract, the certificate of

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the engineer in chief of the department of docks and ferries having jurisdiction of the work that there had been earned under the contract a sum sufficient to entitle the contractor to the payment represented by the warrant sought, was sufficient to establish a prima facie case in favor of relator. People, ex rel. Rolf, v. Coler, Comptroller, 68 N. Y. Supp. 448.

Obstruction in Street.—A platform slightly narrower than the sidewalk projected out over the sidewalk, on a level with the second floor of an abutting building. The building was used to store baled hay and straw, and the platform was used in unloading and loading the bales from wagons in the street below. *Held*, that the platform was not a nuisance and an obstruction in itself, so as to impose a liability on the city for permitting it to remain and be used for the purpose indicated, since the municipality had a right to presume that it would be properly used. Parmenter v. City of Marion, 85 N. W. Rep. (Iowa) 90.

Sidewalks Off Grade.—When a municipality, vested with the power of maintaining uniform grades of sidewalks, permits one proprietor to raise his sidewalk, and lets the grade of the sidewalk in front of the adjacent property remain out of grade for more than a year, and, owing to the abrupt rise of about five inches at the dividing lines of the two sidewalks (where there was a long shed, and no light), an accident happens, the city is liable for damages occasioned to a pedestrian who falls because of the obstruction and injures herself. Blume v. City of New Orleans, 29 So. Rep. (La.) 106.

Defective Streets.—A street connecting with a bridge at an angle extended five or six feet beyond the line of the bridge, leaving an exposed place, which led to one side of the bridge, and across an unguarded abutment into the river. A pedestrian about to enter the bridge was suddenly confronted by a bicyclist, and, to avoid a collision, jumped to one side and fell off the end of the street. *Held*, that, though the bicyclist had no right on the sidewalk, and the city could not have foreseen that he would be there unlawfully, he was not the proximate cause of the injury, but the city's failure to keep the abutment guarded, being a contributing cause, rendered the city liable. Knouff v. City of Logansport, 59 N. E. Rep. (Ind.) 347.

Contractor's Bond.—A bond given by a contractor to a city was conditioned that he should pay to any and all persons all money due for labor and material furnished, and that he should comply with the provisions of an ordinance, which provides that a person entering into a contract of construction with the city shall give a bond that he will promptly pay all persons supplying him with labor or materials in the work; and any person or persons applying therefor, and making affidavit that labor or materials for the work have been supplied by him or them and not paid for, shall be furnished a copy of the bond, on which he or they may bring suit, and prosecute it to judgment and execution, indemnity against costs first being furnished the city. *Held*, that separate actions on the bond can be maintained by different subcontractors, and that recovery of one judgment for part of the amount of the bond, and satisfaction thereof, does not prevent maintenance of actions by others. City of Philadelphia v. Stewart et al., 48 At. Rep. (Pa.) 275.

MUNICIPAL OWNERSHIP.*

By L. N. Case, Manager of the Water and Light Department, Duluth, Minn.

I can bring no stronger argument in favor of municipal ownership of public utilities than this: That, after a service of thirty-five years, connected with their operation by the people, thirteen years of which was passed in direct management of such operations, I am today more enthusiastic than ever in its favor—more thoroughly imbued with a belief in its profound justice, and more confident also of the great benefits to be derived therefrom by the common people, the great industrial and wage-earning classes; men, women and children, who are engaged in labor by which they secure to themselves and those dependent upon them the necessaries of life.

I have said that one-half of the people have nothing of this world's wealth, many not even a place to rest. There is one thing, however, that they do possess, and that is a common right and ownership in our streets and alleys, an inalienable right to all of the privileges of these public highways. The installation and operation of public utilities require the permanent occu-

*From a paper read before the Economic Club Feb. 27, 1901.

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pation of a portion of this, the people's property.

This privilege is valuable. Wealth is seeking constantly for its possession, because of the large gains that can be obtained by thus occupying the property of the people and conveying to the people the necessaries of life. Gas, electric light, telephones, or street cars are not usually reckoned among the necessaries of life, and yet each, in its way, is necessary to the lives we lead. These privileges are being sought for persistently in every community of any size and are being obtained from the people, through their representatives, for a little or nothing, sometimes of course under the mistaken idea that franchises so granted will redound to the benefit of the people themselves.

The main objection to municipal ownership, an objection that is always urged, is that so corrupt are politicians and the representatives of the people, that they can not be trusted in the operation of these public utilities, and yet they are trusted to dispose of these privileges—give them away—barter them to purchasers at private and secret sales, the payments received for which, it is hardly necessary to state, never reaching the public treasury. I am free to admit that there have been failures in municipal ownership because of the corruption of politics, the spoils system and the incompetency resulting therefrom, but I hold that this is no logical argument against it. A violation of a principle is not an argument against it, neither is it an argument against a government by the people because unscrupulous men will always seek to take advantage of, and use it for their own private or dishonest purposes.

In the advocacy of the ownership of public utilities by the people, care should be exercised to preserve the principles upon which it is based. In Glasgow, not only do the people own and operate their water, gas and electric light plants, their street cars and other public utilities, but they are also engaged in the ownership and renting of a large number of tenement houses, as well as in other private industries. While the latter enterprises have tended to improve the condition and character of its people, by providing more wholesome and sanitary houses, healthier food and better clothing, yet I believe that they are in violation of the correct principles underlying municipal ownership. It seems to me that every reasonable and logical argument points to this general principle, that, when it is necessary to occupy the public property of a people in order to carry on a business, that business should be owned and operated by the people in whose interests it is established; and that the people, as such, should not engage in any business that requires only the occupation of private property and which can be maintained by private enterprise and private capital. If the argument is good that because it is a public utility it should be owned and operated by the public, it is equally as emphatic that if it is not of that nature it should not be so owned and operated.

As to the great benefits to be derived from municipal ownership, they can be summed up by the statement, that the people can supply themselves with these necessaries and privileges much cheaper and more agreeably to their needs than when furnished by a private company. And why?

First. It is the custom, almost invariably, both of municipalities and of private companies, to bond themselves for practically the entire cost of construction, the company issuing stock on top of this which represents nothing but the franchise value and the earning capacity of the plant. A municipality can usually float its bonds at par, with interest one or two per cent. less than can a private company. With the usual difference of two per cent. this means an annual expense of $20,000 for each million issue. For the purpose of forming an equation we will designate this expense by A.

Second. A company pays to a few of its trusted and prominent officials considerably larger salaries than are paid by a community; this with its legal adviser and expenses, which a municipality escapes, we will represent by B.

Third. It is generally understood that a company usually has a fund, called by some a "corruption fund," and which is used in obtaining its "right-of-way," to protect itself afterwards in that right and to insure its being "let alone." For this reason I presume, these expenses are frequently charged to "insurance." We will represent these expenses by the letter C—with a rising inflection.

Fourth. It must pay a reasonable dividend to its stockholders, which is really the purpose of its organization, and which we will will represent by D.

Representing the cost of operation and maintenance by the letter E, and the amount of income to be obtained from the people, which of course must be sufficiently large to meet all demands, by the letter I, we have the equation:

A plus B plus C plus D plus E equals I.

With a municipal plant the A, the B, the C and the D are eliminated and we have the simple equation E equals I which means that the rate of charge for the public service depends only on the cost of the operation and maintenance of the plant.

Municipal ownership has not advanced with as great strides in this country as in Europe, it being confined at this date almost entirely to the operation of water plants.

The latest compilation I have been able to

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get is as follows: Water works owned and operated by the people, 1,690 out of a total of 3,196; over one-half. Electric light plants, 302. Gas plants, 12. Street railways, 1, the latter being on the bridge between New York and Brooklyn.

It is evident that the water supplies of communities, being greater necessities than those of light or locomotion, have forced the people's attention thereto and emphasized their demands for good and cheap service. This has resulted in communities largely obtaining possession of their water plants, which in almost every instance, has brought about these very ends demanded by the people.

In regard to other utilities, a less necessity for their use, and the ability of obtaining substitutes therefor, have been to a certain extent the causes of the people not awakening to a realization of the splendid results that can be obtained by acquiring them.

Philadelphia out of its net earnings has paid for its works, and had furnished cheaper gas during nearly all of its history than had the private works of New York, Baltimore or Washington. In 1894 it had done what the Standard Oil, Gould and Sage interests insisted before the New York legislature in 1897 could not be done without ruin, viz: reduced the price of gas to $1.

The works continued to pay operating expenses and depreciation charges, besides furnishing about 700,000,000 feet to the city yearly, worth at even 75 cents $500,000, or fully 5 per cent. on the structural value of the plant.

The recent reduction in this city of both gas and water rates, after a successful operation of these plants a little over two years, is a practical demonstration of this truth, and yet it is but little understood under what peculiarly adverse conditions these results have been produced.

In the first place there was paid for the plants about $350,000 more than their structural value, and although there were considerations that rendered the sum paid a reasonable one, yet it should not be forgotten that the interest on this excess has to be paid annually from the earnings of the works. Again the interest on $295,000 is at 6 per cent., being on the company's bonds and which in the transaction the city assumed, while it floated its own bonds at about 4½ per cent. In addition to this, the city borrowed $1,106,000 to be used in the construction of a supplementary system, and the extension and improvement of the old, upon which there is an annual interest of $55,000, an additional burden upon the earnings of the works. Finally the schedule of meter water rates, from which the department derived three-fifths of its income, was reduced by the council 20 per cent., and the gas rate was also reduced from $1.90 to $1.50 per 1,000.

It is no wonder that there were men in this community who, realizing how seriously the department was handicapped, should boldly state that it could not be self-supporting. I am even not surprised that when subsequent reports were made by the department showing that, notwithstanding these adverse influences, the department was paying, that there were some who claimed that the figures had been juggled. I could afford to smile, however, at these statements, for by that time I had acquired a sufficient knowledge of the conditions to already see the bright promises for the future which by no means, I assure you, are fully realized today.

Of the money borrowed for the building of the supplementary system and the extension and the improvement of the works, there was left for the use of the Board $102,000, with which it has made a large number of extensions, replaced about seven miles of worn out kalamine pipe lines with larger sizes of cast iron, have erected new houses at the pumping works and improved the machinery and grounds, have introduced new and improved apparatus for the manufacture of gas; in fact, a general upbuilding and improvement has been conducted and so judiciously as to call for little if any criticism. About $78,000 of this fund has been expended in this work, leaving still in the fund $24,000. In addition to this sum the board had in cash, cash assets and in operation materials paid for, $45,000 at the close of the year, with interest paid and with practically not a bill outstanding for labor or materials.

These results are but the results of Municipal Ownership, untrammeled by political influences, and operated on business principles alone.

To be successful Municipal Ownership must be real, not simulated; it must be public ownership complete—not private ownership by public officials. And when it is complete, the benefits accruing to the people are invariably widespread and far reaching.

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MODERN BRICK PAVEMENT CONSTRUCTION.*

By W. H. Tarrant, City Engineer, Champaign, Ill.

The early brick pavements of this country, were, to a large extent, failures, because of a lack of knowledge of the requirements of a durable brick pavement and the inferior quality of materials available at that time. The first brick pavement which was constructed in the United States was at Charleston, W. Va., in 1872. This pavement had a foundation of three inches of gravel, well rolled, on this was laid inch boards dipped in coal tar, upon which was placed an inch and one-half sand cushion, then a course of common red brick laid on edge, herringbone fashion and a sand filler. This pavement did not give good results and in a few years was beyond repair.

The next effort to secure a durable pavement was the common two-course pavement, which we see in so many cities today. The earlier pavements of this class gave scarcely any better results than the Charleston pavement, owing to the inferior materials and construction.

A few years ago the construction of brick pavements with a concrete foundation was commenced. By rigid requirements in the specifications and the desire of the brick manufacturers to make more durable brick the result is that we have today the best brick pavements of any country in the world.

The object of this paper is to give a few of the many requirements of a brick pavement, with a broken stone concrete foundation, concrete curb and gutter and one course of brick. This class of pavement is the only one which will give satisfactory results. The writer will divide the subject of construction into the following heads:

First—Sub-grade.
Second—Crown of street.
Third—Concrete curb and gutter.
Fourth—Concrete foundation.
Fifth—Sand cushion.
Sixth—Laying and rolling the brick.
Seventh—Filling the interstices between the brick.

When an ordinance is passed for the paving of a street notice should be given the property-owners along the line of the proposed improvement to make the necessary gas, water, sewer and drain connections to their premises. In case this is not done by the property-owner, the city should make the connections and when the connections are used, charge the actual cost, with interest, to the party making the connection. All connections should be made under the direction of the city engineer or his assistants and should be made in a satisfactory manner. If, by reason of neglect or oversight the private connections are not made until the pavement is completed and the connections are desired, application should be made to the city clerk and an amount deposited sufficient to make the desired connection, concrete the trench and relay the pavement. The work should be done by the city, and when completed, if the amount deposited is larger than the actual cost of connection, the balance should be rebated to the applicant.

If at any time the city authorities grant a franchise or privilege to any company or corporation, necessitating the tearing up of the pavement to lay gas, water or any other mains or connections, there should be a stipulation in said franchise requiring said company or corporation to remove all surplus dirt from the trenches; and, after the mains are properly laid, fill the trench with broken stone or gravel concrete to the required depth; and, in case this is not done, fill the trench with cinders, gravel or well-tamped clay, to within eighteen inches of the top of the concrete foundation. Remove from the sides of the trench enough soil, commencing at the sub-grade and running outward at an angle of thirty degrees, to make a ledge of six inches on either side of the trench, filling the trench with gravel or broken stone concrete upon which to relay the pavement.

With the various connections completed before the awarding of the contract, there can be no delay to the contractor by reason of connections along the line of the work. The grading should be done in the following manner: Where excavation is necessary, no plow should be used within three inches of the finished sub-grade. The remaining excavation should be dressed off with hand tools. Where filling is necessary it should be done in layers of not more than four inches, each layer well dampened and rolled, all soft or spongy places should be removed and filled with gravel well rolled. The surface, after being brought to sub-grade (with allowance for rolling), should be thoroughly rolled with a roller at least five feet in width and weighing not less than two hundred and fifty pounds per inch of width. After the subgrade is thoroughly rolled and ready for the concrete foundation, no loaded or empty wagons or other vehicles should be permitted on the sub-grade, unless it be protected by a covering of boards. All paving material should be placed along the line of the proposed improvement before the completion of the sub-grade.

The cross-section of the street should be

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PEARL STREET BRICK PAVEMENT, CAMBRIDGE, MASS.—MIXING AND PLACING CONCRETE BASE.

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parabolic in form with the vertex of the parabola in the middle of the street. The writer finds excellent results by making the crown of the street equal to 0.014 the width of the street in feet plus 0.03 feet, the constant .03 of a foot being added to the middle ordinate of the street so as to slightly elevate the center and thus avoid a flattened place in the street. By this method we secure better drainage and a cleaner street.

For the residence portion of a city there is no one feature of a brick pavement which adds more to the pleasing appearance of the street than a concrete curb and gutter, and when properly constructed and first-class materials are used it will be as durable as any other portion of the pavement. The the gutter should have a width of eighteen inches and the curb a thickness of five inches for a street having a width of thirty-six feet. The gutter should have a slope of one inch toward the curb. The hight of the curb above the gutter should be seven inches, the upper face edge and the junction of the curb and gutter should have a radius of one and one-quarter inches. The thickness of the gutter should be six inches and the curb five inches, and the construction should be such as to make the curb and gutter one solid mass.

The foundation should be six inches of gravel or cinders, well dampened and thoroughly tamped with a tamper, having an area of not less than thirty-six inches and weighing not less than thirty pounds. The concrete portion of the curb and gutter should consist of one part Portland cement and five parts clean gravel. The cement and gravel should be thoroughly mixed dry, then water added until it is a little more than moist, then placed in forms and well tamped with a tamper, as described for the foundation. The writer is of the opinion that the secret of a first-class concrete curb and gutter is to have the concrete well tamped. The finishing coat should be one inch in thickness and consist of one part of Portland cement and one and one-half parts of clean, sharp sand. The finishing coat should be placed on the concrete portion before the concrete has begun to set, and thoroughly troweled, so as to give a perfect bond between the two. If this precaution is taken there need be no fear of hollow blocks. The concrete curb and gutter should be made in alternate sections and in lengths of seven feet.

The finished curb and gutter should be protected from the sun and wind by a covering of canvas for at least twenty-four hours. In extremely dry weather the curb and gutter should be sprinkled at least once a day for three or four days. The catch basin inlets should be built in the curbs. The best form of inlet is the cover inlet with vertical bars. This inlet will never become clogged by leaves or rubbish on the street.

One of the most important parts of a durable brick pavement is the concrete foundation or sub-structure for the brick. This is one portion of the pavement which, in many instances, is neglected, and one which should have the greatest care. One of the primary elements of a first-class foundation is to have a perfect sub-grade upon which to lay the concrete.

The concrete should be composed of one part of American natural hydraulic cement, two parts clean, sharp sand and four parts of broken stone. If Portland cement is used instead of the natural cement the proportions should be one of cement, three of sand and six of broken stone, or if the gravel is used instead of the broken stone, one of Portland cement to eight of gravel. In recent experiments with the broken stone concrete and gravel concrete (using the natural cement in the broken stone concrete and the Portland cement in the gravel concrete), the gravel concrete gave an increase of strength of 30 to 50 per cent. over the broken stone concrete. The thickness of the concrete foundation should be six inches, and under all street car tracks the concrete should have a depth of six inches below the bottom of the ties.

The sand and cement should be thoroughly mixed dry until it has a uniform color. Add enough water to give it the proper consistency; then add the broken stone; mix three times and then shovel into the work. To give the surface of the concrete foundation the proper crown, the best method is to set a line of stakes along the center of the street about three feet apart, then by means of a templet with one end on the center stakes and the other on the curb, set a line of stakes perpendicular to the curb line and about three feet apart, driving the stakes to the exact surface of the finished concrete. By this method the grader has ample opportunity to bring the surface to a perfect grade.

One of the most important parts of the concrete foundation is the tamping of the concrete, and it is one which is very often neglected. The concrete should be thoroughly tamped with a tamper weighing not less than thirty pounds and having an area of not more than twenty-five inches. After it is sufficiently tamped with the iron tamper and any hollow places appear, they should be filled with cement mortar and again tamped with an oak tamper about eighteen inches square. The surface of the concrete should then be parallel to the surface of the finished pavement. Much depends upon this, and if not done the pavement, when completed, will be flat in places and have a wavy appearance. After the concrete has set a few hours it should be covered with a half inch of clean, moist sand. In extremely dry and hot days it should be sprinkled a

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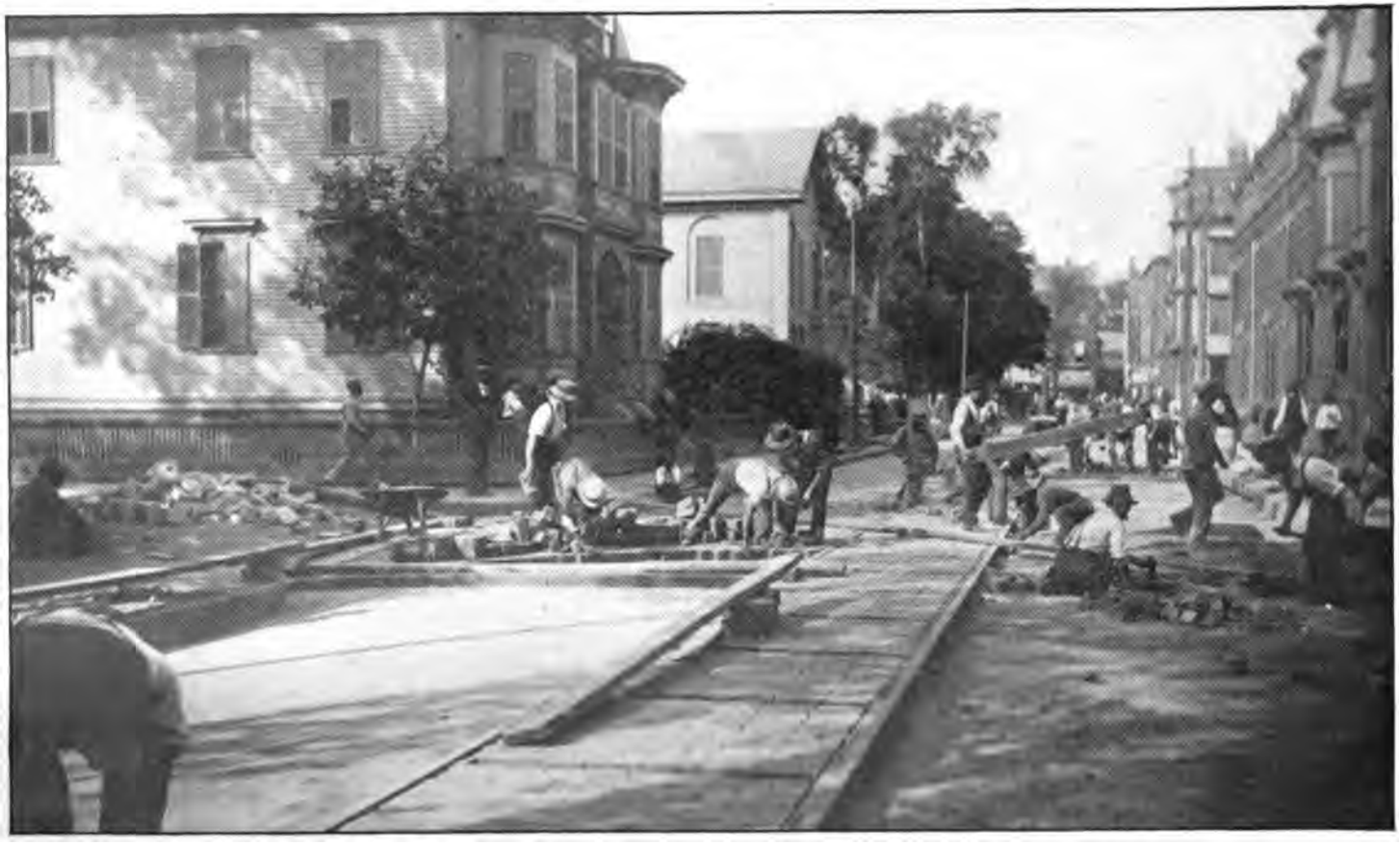

PEARL STREET BRICK PAVEMENT, CAMBRIDGE, MASS.—PLACING THE BRICKS ON SAND CUSHION.

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few times each day until the bricks are laid.

The sand cushion should be of clean dry sand and have a thickness of one and one-quarter inches. The sand should be graded by means of a templet, having the exact contour of the street. It should be so constructed that one end of the templet will rest on strips in the center of the street and the other end on the curb. The sand at all times should be perfectly dry.

The bricks should be laid in rows perpendicular to the curb, except at street intersections where they should be laid at an angle of forty-five degrees. Bats should be only used in commencing the rows and making the closures, and in no other places. The brick should be laid with the least possible space between them. Wheeling on the pavement should be done on boards and the brick should be dumped from the barrows in the direction of the rows. After the brick are laid they should be carefully inspected, all chipped brick should be turned, the soft and defective ones should be thrown out and replaced with good ones.

The best method of laying brick between street car tracks is to lay the brick parallel to the rails. One row on the outside of the rails should also be laid parallel to the rail. This row gives the trackmen a chance to tighten up the bolts or drive spikes without molesting more than one row. The first row on the inside should be laid flat, when a six-inch "T" rail is used. The remaining rows are laid on edge and if the three and three-eighths-inch brick are used no cutting is necessary.

The rolling of the brick should be done parallel to the curb, commencing at the center and rolling toward the outside. It should be done with a roller weighing not less than 200 pounds per unit inch in width. The pavement should be rolled at least three times. After the rolling is done the brick should have their final inspection and all broken or chipped brick removed, and replaced with good brick.

If the brick are standard brick and not repressed, sand makes the best filler, but if they are repressed brick the Portland cement should be used. If the manufacturers of paving brick would discontinue the use of the repress machine we would have a better quality of brick. The repressing of the brick destroys the bond which is given the clay when it comes from the brick machine and the repress machine does not put enough pressure on the brick to make a new bond. The result is that after the brick are burned and placed in the street they scale off on the edges. In the standard brick the bond is not broken and the brick do not scale or chip in the street.

If the sand filler is used the sand should be clean, sharp, dry and fine. The sand should be placed on the street in thin layers and thoroughly broomed into the joints with steel brooms. When the interstices of the pavement are all filled a half inch of sand should be left on the pavement.

If the grout filler is used it should consist of one part of Portland cement and one part of clean, sharp sand. The cement and sand should be thoroughly mixed dry, in a tight box about two and one-half feet wide and about four feet long; water should be added until it has the consistency of thick cream, then poured on the pavement and broomed into the joints. It should be applied in two courses, the second course be mixed a little thicker than the first. When the joints are well filled and the cement is allowed to set for a few hours, a coat of sand should be placed over the pavement to protect the grout from the wind and sun. The grout should be allowed to set from seven to ten days before the traffic is turned on the street.

CURRENT INFORMATION

Connecticut Sewerage Commission on Sewage Disposal.

The second annual report of the Connecticut sewerage commission summarizes the views of that body on the different methods of sewage disposal now in use as follows:

1. The chemical precipitation of domestic sewage, first and most extensively practiced in England, has proved to be very unsatisfactory. It is very expensive and at best can only prepare the sewage for purification, a work cheaply and effectively done by the septic tank. A single possible use for it is this: Where many large adjacent manufacturing establishments contribute chemicals and very refractory waste matters which are injurious to the bacterial life of the filters, it may prove to be economical to separate them in a special sewer and make them innocuous by chemical precipitation. Probably the sludge thus made would carry less water and be more dense than that from the treatment of house sewage, and its disposal for these reasons would be less burdensome.

2. The cleansing of sewage by bacterial action is the only method which seems, at present, to give promise of widely successful application. To the study and practical operation of this method the work of all sanitary engineers is at present directed. No other known method actually destroys the putrescible matter in sewage, making the effluent clear, not poisonous to fish and incapable of putrefaction. No other known method can, therefore, perfectly satisfy reasonable requirements in those cases where

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PEARL STREET BRICK PAVEMENT, CAMBRIDGE, MASS.—SPREADING PORTLAND CEMENT GROUT.

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the effluent must be discharged into streams or shallow harbors.

3. Largely by the experiments and advice of the Massachusetts State Board of Health the capacity, durability and efficiency of sand filters for the bacterial treatment of sewage beds has been determined. With a sufficient and not exceedingly large area, crude sewage can be handled on them, yielding very clear and clean effluents. There is no clogging of the filters, and while their efficiency is very considerably reduced in severe winters—owing partly to the lessened activity of the bacteria in them, and partly to the impossibility of cleaning the surface of the beds—they are operated successfully the year through in Massachusetts and in Connecticut.

Sand filters themselves efficiently screen the sewage. The sludge, consisting of paper with solid animal and vegetable refuse of all sorts, does not work down into the sand, but stays on or close to the surface, and if not removed simply retards the work by checking the flow of sewage into the sand. When the filter rests, this sludge dries to a thin crust, easily removed by raking, and is composted or directly plowed in, making a fairly good fertilizer.

4. The sand filter has its limitations. In the first place, for cleansing the sewage of very large cities ,the filter area must necessarily be very large and relatively much more expensive because of the high cost of land near large centers. Secondly, only very open, coarse sand can be profitably used for filters, and such sand is often not to be found where it is needed for the purpose. This last condition prevails almost everywhere in England, and has made necessary the very expensive and elaborate experiments with socalled bacterial beds.

5. Bacterial beds are artificially made, being filled with some kind of broken material very much coarser than sand. Burnt clay, furnace clinker, coal, even crushed granite and refuse metal scrap have been used. The depth of the filters is usually from 3½ to 6 feet, though in some cases it has been as great as 13 feet.

The method of operating these filters is quite different from that used for sand filters. The latter are flushed with sewage which is allowed to sink through the sand, the sewage rests for a day or more, the beds are raked, and then flushed again. The former are filled slowly up to the surface of the filtering material with sewage, which is allowed to stand for two or three hours and is then slowly run off. After a rest of only a few hours, the operation is repeated, two, three or four times in twenty-four hours. The effluent from the first or roughing filter is usually passed to a second, filled with finer material, and in a few cases to a third, but the third contact is exceptional.

6. This system at its best will unquestionably handle six or eight times as much sewage as an equal area of sand filters. The effluent is not nearly as pure, but pure enough to meet the present requirements of senitary authorities. The climate of England in winter, which is much milder than our own, does not appear to very seriously affect the working of these beds if the sewage is applied as described. An automatic sprinkling device for continuously applying the sewage to the surface is reported to have disabled the bed in freezing weather and would certainly do so in Connecticut winters.

7. The bacterial bed, like the sand filter, also has its limitations, which are now fully recognized by all English authorities. The material of these beds is so coarse that sludge is not held on the surface but readily passes up or down, depending on the manner of filling, into the body of the filters. A considerable part of it is liquefied and destroyed there, the bacterial filter thus operating like a septic tank, but a part is very resistant and fills up the interstices more or less.

This filling, with careless or unskillful management, is very rapid; with skillful management it is slow. The commission believes, however, that the experience even with screeened and settled sewage has not yet proved that this filling can be wholly prevented, and that it rather indicates that with all possible care sewage will so seriously impair the filters in no very long time as to make renewal necessary, unless practically all the sludge is removed from it by some preliminary treatment. This operation of renewal, at least under Connecticut conditions, would be very expensive.

8. This brings up again the problem of the removal and disposal of sludge, the suspended matter in sewage. No mechanical arrangement of gratings or sieves has yet been devised which can do the work required. Once remove the sludge and the problem seems to be solved. If the sewage is free from it, there is no reason to doubt that the bacterial filters can handle seven or eight times as much sludge-free sewage as an equal area of sand filters can handle of crude sewage, and will maintain their efficiency indefinitely.

The most efficient means of removing this sludge has proved in England to be the septic tank. It has long been in successful operation at Exeter; at Sutton it has insinuated itself into use with a system originally devised to remove the sludge by a roughing filter; at Manchester it has been finally adopted as part of the disposal system of a great manufacturing city, by a commission of undoubted ability, which made a thorough test of it. It may be that the septic tank, in some places and with some kinds of sewage, will prove unnecessary, and that the whole work can be done on bacterial filters.

Any careful observation of a number of sewage-disposal works emphasizes the fact that while the broad principles involved are the same everywhere, no two problems are precisely alike, and each particular case has to be studied by itself and the system modified to meet local conditions and the special character of the sewage to be treated. It has still to be determined whether the septic tank and bacterial filter can be used in the Connecticut climate in their present shape, or whether they can be so modified as to be successfully operated here during the summer and winter. The work of sewage disposal in England under the special conditions imposed by the demands of sanitary authorities, the general character of the soil and the geographical situation, is still in the experimental stage. No large manufacturing

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centers have disposal works which have been in perfectly successful operation for a considerable number of years. The septic tank is no longer an experiment. The bacterial filters operating on sewage quite free from sludge are, the commission believes, certainly successful, and will continue so indefinitely without renewal. At any rate, the work now being done at Manchester will, if managed with the same skill as the preliminary experiments, finally settle these two points.

9. The cleansing of the sewage of large manufacturing cities is often made specially difficult because of the discharge into sewers of manufacturing waste water either containing in solution various chemicals which greatly interfere with bacterial filters or carrying in suspension material which clogs these filters. Examples of such matters are pickling acid, soap, paper-mill waste, bleach and gas liquors. These have at present to be accepted in the sewers and cared for by the city. In many cases, however, such waste could be, in part, at least, kept out of the sewers and out of the waterways by private manufacturers, without loss and even with a profit to themselves. The following interesting examples are described by Dr. W. H. Wilson:

The county of the West Riding of Yorkshire (which includes the cities of Leeds, Sheffield and Bradford, and the boroughs of Halifax and Huddersfield), has a population of 2,444,391, engaged chiefly in the manufacture of textile goods, leather, iron and steel, and in coal mining. In this county there are more than 2,000 factories discharging trade refuse into the sewers or streams. Those manufacturers in the iron trade who used to discharge waste pickle, made from sulphuric acid, have found in several cases that it is easy to obtain from this pickle by crystallization the copperas it contains, and to use over again the acid mother liquor, and in this way to cease discharging the waste pickle into the stream, and at the same time to affect an economy by its treatment. The manager of the Hallanshire paper mills, near Sheffield, has assured the board's inspector that he is able to rinse the fiber, etc., caught in the settling ponds he has provided for the treatment of his trade waste, and that by so doing he has far more than recouped himself for the cost of the works. The manager of the Calder Grove paper works, near Wakefield, also states that all the sludge deposited from the waste water in the settling tanks he has provided, can be made up into paper. In both these cases the sludge is used also with other materials for the manufacture of the coarser kind of paper. In the case of bleach works it has been found that the measures adopted by the manufacturers have resulted in a saving. The occupier of the Woodside bleach works, Rawdon, has saved £6 a month by rinsing the bleach liquor which formerly he discharged into the stream. At several soap works the manufacturers have erected plants for the recovery of the glycerine from the lyes and have thus stopped the former pollution of the stream and at the same time made a profit.

The commission makes the following recommendations:

1. The disposal of sewage without nuisance is a duty which each community owes to the public. It is a problem to be settled by each community for itself, with such state supervision and control as is necessary in the public interest.

2. No city, borough or town which has not now a sewerage system should be allowed hereafter to build one which will discharge sewage or polluted water into any stream, whether such stream at the time is used by others for sewage disposal or not; nor should private corporations or individuals be allowed to discharge house sewage or excreta into any streams or rivers.

3. To insure sewerage construction and methods of sewage disposal which will be permanently satisfactory, the general assembly should not grant to any corporation, not now operating a municipal sewerage system, authority to issue bonds for building, or to condemn land for building, or to build any sewers or system of sewers, until an accurate topographical survey of the region to be sewered has been made, and, together with plans for effective sewage purification before discharging the effluent into any stream, has been submitted to and approved by some competent state authority.

4. Provision should also be made by which cities and boroughs now having sewage disposal works, or which may hereafter build them, may be compelled by the state to so manage them that the sewerage shall at all times be effectively purified, so as not to create a nuisance by its discharge into rivers.

Bacterial Treatment of Sewage at West Bromwich, England.

A report on bacterial treatment of sewage at West Bromwich, England, by A. D. Greatorex, borough engineer and surveyor, has been adopted by the town council. The beds have been in operation over twelve months. The beds, both coarse-grained and fine-grained, are 120-ft. long by 60-ft. wide. They are constructed at right angles to the main outfall conduit, the walls being of 18-in. brickwork in cement mortar on concrete foundations, the floors of the beds also being of concrete. The average depth of the filtering material in the coarse-grained bed, which is screened engine ashes from ½-in. to 2-in. mesh, is 3-ft. 6-in., and in the fine-grained bed, which is screened engine ashes from a ¼-in. to ½-in. mesh, is 3-ft. By means of three 15-in. penstocks the sewage reaches the coarse-grained beds direct from the main outfall sewer. The troughs for distributing the sewage are of iron, 15-in. wide, laid upon the surface of the filtering medium. The beds are not under-drained, but have six- 4-in. sluice valves on either side connected to 6-in. and 9-in. cast iron pipes, which discharge into manholes at the bottom end of the beds. The coarse-grained bed discharges into the fine-grained bed, and the fine-grained bed discharges into a 12-in. earthenware pipe, which is connected to a pump well near the engine house, whence the effluent is lifted onto area No. 11, in accordance with the conditions laid down by the local govern-

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ment board. Each of the beds has an effective area of 800 sq. yds., or 1-6 acre.

The sewage was turned on to the beds on Oct. 3, 1899, and they were worked daily until Nov. 1, from which date the beds received two fillings each per day until Nov. 20, when they were filled three times per day until Dec. 5, when they rested until Dec. 12. From this date up to the present they have received three charges per day, Sundays excepted in all cases. From Nov. 1, 1899, to Nov. 1, 1900, the beds received 813 charges of rough-screened crude sewage. The object of the coarse-grained bed is not to effect the final purification of the sewage, but to take the place of the usual chemical treatment, settling tanks, etc., leaving the final purification to be carried out by the finer beds or land.

The coarse-grained bed constructed on the high level is 60-ft. long by 42-ft. wide, adjoining the existing detritus tanks, built in a similar manner to the low-level beds, with an average depth of filtering material of 3 ft. The sewage passes first through the detritus tanks, then through two 15-in. valves on to the bed, being distributed by means of two 15-in. cast iron troughs. The outlet for the filtrate is made by means of six 4-in. valves connected to 6-in. and 4-in. cast iron pipes, discharging into two manholes, and thence by means of a 9-in. earthenware pipe onto area No. 18, the land taking the place of the fine bed. The area of this bed is 280 sq. yds., or about 1-17 acre. The sewage was first turned on to the coarse bed Sept. 12, 1899, the crude sewage being first passed through the detritus tanks. The bed was worked twice every 24 hours, except Sunday, until Nov. 20, 1899. Since that time the bed has received three charges per day, except Sundays, with the exception of a rest from Dec. 5 to Dec. 12. From March 1, 1899, to Nov. 1, 1900, the bed has received 816 charges of crude sewage.

The method of working the beds is as follows: The sewage flows into the coarse-grained bed until the water level has nearly reached that of the bed material. The inlet valves are then closed and the bed allowed to stand full during about two hours. If much longer time is allowed, there is danger of anaerobic action replacing the aerobic, if much less, insufficient time is given to the organisms in the bed to perform their proper functions. During these two hours the suspended matters are deposited in the interstices of the bed, and are partly dissolved while the organic matter in solution is also attacked and oxidized to the extent of about one-half. The bed is then emptied on to the gravel bed, and a resting period of equal duration is allowed. Any quantity of suspended solids that may have escaped the coarse bed, is finally arrested, rendered soluble and oxidized and the purification of the dissolved putrescible matters is continued. When land of a suitable character is available the second series of beds may be dispensed with, the effluent from the first set being very suitable for irrigating purposes, inasmuch as the task thrown upon the land is greatly lightened, there being no suspended matters to clog the pores of the soil, and while the mineralisation of the dissolved organic compounds, which must take place before they are available as plant food, is already far advanced, the material value remains, but many of the troubles incidental to sewage farming are removed.

The report says that the work of a bacteria bed is not finished when the effluent has been discharged; there remains in the bed the sludge, of which only a portion will have been dissolved and oxidized while the bed was full.

The interstices of the bed being now filled with air, which replaces the water as the latter flows away, the aerobic organisms are provided with the conditions necessary for their well-being and rapid reproduction; they have food, moisture, oxygen, darkness and an even temperature. Under these circumstances the deposited organic matters are rapidly attacked, and in the course of a few hours the bed is ready for another charge.

The beds are allowed to stand empty for three hours, and are used three times every twenty-four hours.

The final effluent is clear, entirely without odor, remains perfectly sweet on keeping, is not liable to secondary offensive or putrefactive decomposition, and is fit to discharge into the River Tame, however small the relative volume. Since the beds have become regular in their action neither the effluent nor the beds have become foul.

It will be seen, therefore, that the action of the bacteria beds gives us something beyond mere filtration—viz., a chemical action upon the organic matters in solution and evidently a much greater purification than is represented by the mere withdrawal of suspended matters, as, in addition, it digests the organic solids left behind, a process which, if incomplete, can probably be completed by adequate periods of rest.

The report points out that the object of these beds was to determine whether the sewage of West Bromwich could be successfully treated by the biological methods at all times of the year. The object of the fine-grained bed on the low level was to prove whether the effluent could be satisfactorily purified without any application to land so that by the construction of such beds a saving could be made in pumping. As constructed the beds are so arranged that they will be permanently utilized to purify sewage and consequently no expenditure on structural works or materials has in any sense been wasted or lost. The report says:

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In order that a baeterial contact bed may exercise its full powers of purification it is necessary—

(a) That it should be allowed sufficiently frequent and prolonged periods of rest.

(b) That the sewage applied to it should, as far as posible, be free from suspended matter.

(c) That the sewage applied to it should be of as uniform a character as possible.

The above conditions are best secured by passing the sewage as it arrives at the works through an adequate system of screens and tanks. Sewage contains in suspension and in solution organic and mineral matter; the mineral matters in suspension, such as grit, must be removed by the settlement before subjecting the sewage to bacterial treatment; such an arrangement has the further important advantage of leading to the development of those anaerobic or septic processes which resolve into gaseous and soluble products the organic suspended matter present in the sewage. A large proportion of the sewage which would otherwise accumulate, and the disposal of which is the source of so much difficulty and expense, is thus abolished. The above anaerobic or septic process is found to take place as effectively in an open tank as in a closed one.

The sewer committee authorized Mr. Greatorex to have the necessary samples of sewage and effluents in connection with the experimental works analyzed by H. Silvester, the borough analyst. The various sewages and effluents were mixtures of samples collected, some half hourly, and some every quarter of an hour, throughout periods to insure, so far as practicable, the same sewage being analyzed throughout the process. The analyses of the numerous samples of crude sewage and effluents were as follows:

The average amount of suspended matter contained in the sewage for the low-level trials was 77.39 parts per 100,000, or 54.17 grains per gallon, and it will be seen from the average results of these analyses that the matters in suspension in the crude sewage were reduced in the filtrate from the coarse-grained bed to 9.34 parts per 100,000, or 6.54 grains per gallon, and were still further reduced to .95 parts per 100,000, or .66 grains per gallon, in the final filtrate from the fine-grained bed. The effluent from the land contained traces only.

The reduction of the oxidisable matters in solution was from 3.251 to 1.512 parts per 100,000, and then to .457 parts per 100,000, thus showing an average reduction equal to 53.4 per cent. by the coarse-grained bed, and a total reduction equal to 85.9 per cent. by the combined beds. The total purification after land treatment was 88.9 per cent., the oxidisable matter being reduced to .460 per 100,000.

The reduction of the nitrogenous organic matters, as indicated by the albuminoid ammonia, was in like manner 47 per cent. by the coarse-grained bed and 78.6 per cent. by the combined system. The total purification after land treatment was 82.4 per cent.

The average amount of suspended matter contained in the sewage for the high-level beds was 60.97 parts per 100,000, or 42.68 grains per gallon, and it will be seen from the analyses that the matters in suspension in the crude sewage were reduced in the filtrate from the coarse-grained bed to 6.46 parts per 100,000, or 4.52 grains per gallon, and were still further reduced to .66 parts per 100,000, or .46 grains per gallon in the final filtrate from the land.

The reduction of the oxidisable matters in solution was from 5.034 to 2.165 per 100,000 and then to .369 parts per 100,000, thus showing an average reduction equal to 59.9 per cent. by the coarse-grained bed, and a total reduction equal to 92.6 per cent. by the combined bed and land treatment.

The reduction of the nitrogenous organic matters as indicated by the albumnioid ammonia was in like manner 54.6 per cent. by the coarse-grained bed and 93.2 per cent. by the combined system.

As the chlorine in the sewage is higher than in the final land effluent, a slight correction is necessary to make the effluent strictly comparable with the original sewages. Reducing the sewage and effluent to a common chlorine standard, the percentages of purification are as follows: From oxygen absorbed figures, 90.7 per cent.; from albuminoid ammonia figures, 91.5 per cent.

The results have been all that could be desired, and after twelve months' working the beds are now in as good a condition and as free from nuisance as they were after the first filling.

In order to show that the effluents from bacteria beds are better than the water in the River Tame, analyses of water from the River Tame above the sewage farm were made.

The capacity of bacterial contact beds has been found to remain practically constant after they have been in operation for a period of three months, and in round numbers is said to be about one-third of the tank capacity. Gaugings were taken at Friar park to ascertain the capacity of the beds from time to time, and it has been found that this capacity is somewhat less than one-third of the tank capacity, being only about one-fourth. This is due to the want of proper detritus tanks, and will be obviated in the scheme proposed.

The bacterial system of treatment is efficacious at all seasons of the year, the temperature of the sewage being sufficient both to prevent any stoppage of the beds by the formation of ice and also to maintain the necessary activity of the bacteria even in the coldest weather. On no occasion has any difficulty been experienced in working the beds during frost. The comparatively high temperature of the sewage, even in the coldest of weather, is of importance, not only in preventing the choking of the beds with ice, but also because such a temperature is necessary for the exercise by the bacteria of their functions of purification.

The experiments show that the sewage of West Bromwich can be successfully purified by the bacterial process.

The bacterial system of treatment is efficacious at all seasons of the year.

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The final effluent from the fine-grained bed on the low level is sufficiently pure to discharge into the stream without being applied to further land treatment.

The low-level sewage should be passed through detritus tanks, so as to remove as much mineral and suspended matter as possible.

The detritus tanks on the high level require to be enlarged, as they are of insufficient capacity to deal with the quantity of sewage discharged by the high-level outfall sewer.

I am now in a position to report that the experiments together with very careful observation in treating the sewage of West Bromwich, have enabled me to decide to recommend, without hesitation, a process and scheme which I have every reason for believing will successfully meet your requirements for a long time to come.

Before explaining such scheme it is necessary to point out the conditons laid down by the local government board. As at present advised the board consider whatever system is adopted as a means for dealing with the sewage, it is necessary that provision should be made in the scheme for—

1. Treating fully as ordinary sewage a volume of mixed sewage and storm water equal to three times the daily dry weather flow of sewage.

The board has, however, lately modified this clause as follows: Where a separate system is in existence, and where the sewage is domestic only, the volume of sewage and storm water to be fully treated as foul sewage may be reduced to twice the dry weather flow instead of three times, as formerly required.

2. Dealing with the excess of storm water up to six times the dry weather flow, either by passing it through a special and separate storm filter of sufficient extent, or by delivering it in a special area of prepared land other than that in use for the treatment of the effluent from the ordinary tanks and filters.

If a special storm filter is provided for this purpose it should be of sufficient extent to allow a rate of filtration of 500 gallons per square yard per diem.

3. The capacity of the beds to be taken at one-third for the fluid and two-thirds for the filtering material.

4. That bacteria beds shall be worked in cycles of not less than eight hours for filling, emptying and rest for aeration.

In view of the experience gained I beg to suggest as follows:

1. That the sewage of the low level be passed through detritus tanks, so as to retard the flow of the mineral and organic matters in suspension. These tanks, I suggest, should be three in number.

2. That the settled sewage from the detritus tanks can be passed through a series of bacteria beds, both coarse and fine, nine of each number (of which the existing two will form part), constructed of the same size and area as the two existing beds, but will be one foot deeper. The total area of these beds will be 14,400 square yards, and should, according to the local government board's requirements, be capable of treating 1,600,000 gallons per twenty-four hours. The final effluents from the fine-grained beds to be collected and passed over an aerating bed, having an area of about one thousand square yards, and thence direct into the brook. If the final effluent has to be pumped, I would suggest that areas Nos. 14, 15, 16, 17, 18, 19 and 20 be reserved for this purpose. These areas have a collective area of about forty-seven and one-half acres.

3. That the flood-water after the first washing of the sewers be treated on areas Nos. 1 to 9 and 11 to 13, which have a collective area of about thirty-four acres. This will allow for the treatment of about 3,000,000 gallons of storm water per day.

4. That the high-level sewage, after it has passed through the existing detritus, be treated on nine coarse-grained bacteria beds, constructed of the same size and area as the existing bed, only one foot deeper. The total capacity of these beds will be 2,160 square yards, worked in the same manner as the lower beds, and should, according to the local government board's requirements, be capable of treating about 540,000 gallons per twenty-four hours.

5. Additional detritus tanks should be provided, or the coarse-grained bed converted into a detritus tank and lengthened by about forty feet. This is provided for in the estimates.

6. That the effluent from these beds be conveyed by means of earthenware pipes to areas Nos. 26 to 30, and treated by them instead of fine beds. They have a collective area of about twenty-eight acres. Thence it will pass directly into the brook.

7. That area No. 23 be filled with rough ashes, to form a special storm-water filter. This filter would, I feel sure, successfully deal with the excess of flood water beyond the bacteria beds. It should be capable of treating 2,000,000 gallons of storm water if filled to an average depth of three feet.

It will also be necessary to under-drain the remaining suitable areas of the farm, which have a collective area of about twenty-two acres.

Sanitary Regulations in London.

The general purposes committee has recently submitted to the London county council a report on the result of a conference with the representatives of the city corporation and the various metropolitan vestries and district boards for the purpose of considering sanitary subjects, for the control of which additional powers are necessary.

With reference to house refuse and its removal the report says:

What may be described as the most primitive conveyance in use in London is a two-wheeled cart, open at the top and provided with a tarpaulin, which is usually kept folded up in front, but is sometimes used after the loading has been completed. The cart is loaded by the assistance of a short ladder placed against the side, and the bin or basket is tipped into the open cart, permitting the dust to be blown on to passersby, and paper and similar light material to be scattered over the road.

An improved conveyance employed by

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some of the authorities is a covered one, with wooden or metal flaps, and a yet further improvement is a wagon with an iron top divided into sections, which slide to admit of the bin or basket being tipped, the object of the divisions being twofold—firstly, to limit the exposure of the contents of the vehicle; and, secondly, to facilitate loading evenly, and thus utilizing the entire capacity of the van. Objections have been made to this kind of wagon, because the slides were apt to get fixed, owing to a want of a little care on the part of the men. The opinion was, however, expresed at the conference that the men could be trained to the proper use of the sliding covers.

The conference, having in view that various districts of the metropolis might want different kinds of vehicles, contented themselves with passing the following resolutions based on a general principle: That in the opinion of the conference carts and wagons for the removal of dust, etc., should be so constructed as to prevent, while loading and removing, the escape of their contents, and also, as far as possible, bad smells; and that the open carts of the fashion at present in use should be fitted with a tarpaulin cover, supported by a longitudinal bar.

In the event of a scavenger's cart fulfilling the above conditions not being employed, the conference considered it desirable that some alternative system should be adopted. They accordingly passed the following resolution: That as an alternative system to an improved scavengers' cart the best system of removing dust, etc., would be by using duplicate bins, one containing the refuse being removed from the house and placed on a trolley and an empty one left in its place at the house. We are informed that in some towns the bins are provided by the sanitary authorities for the householders, who pay a small annual sum for their hire.

As regards the times for removal it was stated that in some districts of London occupiers objected to the frequent collection of house refuse. In Edinburgh and some other places the system is to collect daily from every house. The conference, with a view of discouraging the accumulation of house and other refuse, resolved: That, in the opinion of the conference, house refuse should be removed daily where practicable.

Mention having been made of the danger and inconvenience caused by scavengers owing to house refuse being sometimes kept in inaccessible places, it was resolved: That it would be desirable for the council to make a by-law requiring the provision of proper access to the receptacles for house refuse, and especially so as to avoid climbing area railings and descent by ladder to the basement.

The council's by-law with respect to dust receptacles is as follows: When any person shall provide an ashpit in connection with a building he shall cause the same to consist of one or more movable receptacles sufficient to contain the house refuse which may accumulate during any period not exceeding one week. Each of such receptacles shall be constructed of metal and shall be provided with one or more suitable handles and cover. The capacity of each of such receptacles shall not exceed two cubic feet: Provided, that the requirement as to the size of each of such receptacles shall not apply to any person who shall construct such receptacle or receptacles in connection with any premises to which there is attached as part of the conditions of tenancy the right to dispose of house refuse in an ashpit used in common by the occupiers of several tenancies, but in no case shall such ashpit be of greater capacity than is required to enable it to contain the refuse which may accumulate during any period not exceeding one week. The conference thought it was undesirable to make any alterations as regards the dust receptacles specified in the by-law made by the council. On the question of fixed ashpits, however, the conference passed the resolution: That, in the opinion of the conference, it is desirable that fixed ashpits should be abolished and movable receptacles provided in their place.

With reference to cleaning streets and footpaths, watering, etc., the report says:

The best method to be adopted for cleansing and watering of roads is one presenting considerable difficulty, having regard to the various kinds of paving in use. Having given the matter careful attention, the conference has passed the following resolutions: That, in the opinion of the conference, all streets paved with asphalt, wood or granite setts, should be well washed, after first sweeping off and removing all the rough dirt and cleaning the channels, the local authorities providing properly constructed catchpits. That, in the opinion of the conference, greater supervision of the scavenging is absolutely essential to insure the efficient cleansing of the roads and footways of the metropolis, and that the surveyor to the local authority should have sole responsibility for, and unrestricted control over, all labor employed. That as a general proposition, where they can be suitably employed, machine brooms are to be preferred to hand labor. That, in the opinion of the conference, it is desirable that local authorities should provide sweepers for specified areas for the systematic sweeping of the crossings of main thoroughfares. That, in the opinion of the conference, the sprinkling of roads should be done by vans or carts, and that, having regard to the various considerations which apply, it is preferable to water the sides of the roads and channels as frequently as necessary to lay the dust, and the center of the road at less frequent intervals, with the idea that the road shall not be all wet at the same time.

The question of the material to be employed for making up roads being one of

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considerable importance, a sub-committee was appointed to consider and report upon the matter. The result of their deliberations was to show that, speaking generally, it was inadvisable to prescribe one particular form of paving for all streets. The conference, after discussing the question at some length, decided to take no action in the matter.

In connection with the question of best way of showing the names of streets, the conference passed the following resolution:

That, in the opinion of the conference, the best means of showing the names of streets on buildings is by means of painted iron name-plates at the corners and intersections of streets; that the best means of showing the names on lamp-posts is by means of opal tablets in the public lamps, the letters being burnt in the glass itself; that the names should be attached to the lamps or lamp-posts in such a manner as to be visible both by night and by day; that the names of thoroughfares should be placed at all interesections of cross streets; that the building act committee of the council be requested to consider the desirability of more stringent regulations being passed for the prevention of the wilful injury of street tablets.

In connection with building operations the conference had their attention directed to the question of hoardings, and the annoyance caused by dust during the demolition of buildings. The control and licensing of hoardings is in the hands of the local authorities. It was felt that steps should be taken for limiting the period for which hoardings remain up. The opinion was expressed that there had been frequent abuse on the part of builders in this respect, as they obtained considerable profit by letting the hoardings for advertising purposes, very much to the annoyance of the owners or occupiers of the adjoining property. The conference thought it would be very desirable that the prolonged continuance of hoardings should be avoided, and accordingly passed the following resolution: That, in the opinion of the conference, licenses for hoardings should be granted for a limited period only, subject to renewal at the discretion of the local authority, and that, if necessary, statutory provision should be made.

On the question of dust during the demolition of buildings it was felt that something should be done to afford the public better protection than they at present have from the nuisance so caused, and the conference passed the following resolution:

That, in the opinion of the conference, when demolitions take place in streets, the owner or contractor should be compelled to prevent annoyance as far as possible by sprinkling water and by the erection of reed or straw screens, or screens made of other suitable material, such regulation to be enforceable either on the information of the police or of any person suffering injury or annoyance.

Several local authorities have urged that some remedy should be found for the frequent opening up of public ways by water, gas, electric light and telephone companies. The conference considered that this constitutes a great evil, and is the occasion of much annoyance to the public generally, and frequently of loss to tradespeople, and therefore should as far as possible be prevented. It was suggested that the local authorities should have more power of control, and that subways should be constructed, when practicable, under the streets in which the pipes, etc., should be laid. The following resolutions were passed: That the conference is of opinion that in all new leading thoroughfares subways should be constructed in which the water and gas mains, pipes, etc., could be placed; that this conference is of opinion that the time has arrived for concerted action on the part of the local authorities of the metropolis to remedy the inconvenience, annoyance, loss of time and money now caused by the operations of gas, water, telephone and electric lighting companies in laying down, renewing, maintaining and repairing their mains, pipes, services and wires.

It was pointed out that frequently the whereabouts of public conveniences are not sufficiently indicated. The conference thought that something might be done to remedy this, and accordingly passed the following resolution: That, with a view to the better indication of the whereabouts of public conveniences, direction tablets should be fixed more numerously than at present in suitable prominent positions.

Asphalt Competition in Buffalo.

The first indication of competition between the branches of the Asphalt Company of America and independent companies appeared March 6 in Buffalo, when bids were received for constructing eleven streets from the American Contracting company, Henry P. Burgard and the Warner-Quinlan company. The Warner-Quinlan company bid on nine streets and received the awards for five, upon which it was the lowest bidder. The press of the city questioned the reality of the competition, an analysis of the bids showing that the old companies bid high on the streets which the new company secured, while the new company bid much higher on the streets awarded to others than it did upon those upon which it was successful.

Analysis of the bids by the city engineer shows, however, that there has been some reduction in prices. Other bids were received on March 15 for three streets, on one of which the Warner-Quinlan company was low bidder, on one the German Rock Asphalt company and on one the American Contracting company. On all the bids received

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thus far this year the city engineer computes the average per square yard for the lowest bids at $2.52, when reduced to the same basis upon which it was computed that the average price last year was $2.65. This indicates a reduction in price of 13 cents a square yard. There is much variation in the price for individual streets, however.

These prices include grading, curbing, setting receivers and all incidentals. In the table of average prices last year, which appeared in Municipal Engineering Magazine last month, these items were eliminated, and the average price for foundation, binder and wearing surface was $2.20 per square yard. The difference between the averages for last year shows the average cost of grading, curbing, setting receivers and incidentals to be 45 cents for that year. If we assume the average cost of these items for the small number of streets bid upon thus far this year to be 45 cents also, we find the average cost of foundation, binder and surface so far this year to be $2.07. This seems to be a fair price. When the city of Indianapolis had actual competition, which was not of the cuthroat order to crush out a rival, this was about the price for the pavement computed on this basis for Indianapolis conditions. Careful estimate of the actual cost of an asphalt pavement under these conditions, with the price quoted for asphalt material, including guaranty and interest on capital invested, indicated that this figure gives a fair margin for profit.

The Illinois Central Railroad an Educator on Good Roads.

The Illinois Central railroad is doing some special work in educating the people along its line as to the possibilities and value of better roads. A train is to be sent north from New Orleans to Chicago to give object lessons in road building. At a number of places the train will stop and pieces of model road will be built. Arrangements will also be made for public meetings for discussing the matter of better roads. This is an enlightened procedure and is almost certain to ultimately return to the railroad company a good interest on the money and energy invested.

City Not Responsible for Cost of Changing Structures Under Streets.

An opinion was rendered by E. T. Price, city counsel at Newark, N. J., March 7, relating to the responsibility of the city for the alteration of gas pipes in the streets. The opinion also covers the liability of the city in regard to the cost for changing trolley tracks, railroad tracks, conduits in streets and all other appurtenances placed in them under franchises granted to corporations or private persons. The opinion is to the effect that the city has no responsibility where, by reason of changes made for the benefit of the public, property of others is interfered with. If the city changes the grade of a street for a reasonable purpose, any railroad tracks in the street must be changed to conform to the new grade, unless such change should destroy the franchise of the company. The same rule is to apply to trolley roads. Changes in pipes and conduits must also be made by the owners without compensation from the city.

The opinion was brought out in connection with the proposed construction of the central relief sewer, which, owing to extraordinard size, will necessitate the changing of telephone conduits and gas pipes.

Specifications for the Construction of Brick Pavements by the N. B. M. A.

The committee on specifications for construction of brick pavements of the National Brick Manufacturers' association, composed of D. V. Purington, W. P. Blair and T. B. Townsend, made the following report at the recent meeting of the association:

Your committee approached the consideration of the question involved in this resolution with considerable embarrassment.

Primarily these questions relate to matters pertaining almost exclusively to the work of civil engineers to whom falls the duty of preparing specifications and superintending their execution, and the manufacturer of brick has little to do with them. There are few civil engineers who will not admit that in an industry so comparatively new as that of brick paving it is possible for mistakes to occur or that there may be honest differences of opinion regarding the method of their construction.

The preliminary work of the committee was devoted to the manner any recommendation they might make should be presented. Indeed, your committee scarcely felt warranted in making recommendations, but simply desire to embody in this report the result of their experience and observation in the form of suggestions and, if possible, to do this in a manner that shall in no way reflect upon the position previously taken by any of the engineers. Your committee, however strong in their own convictions, do not expect absolute unity of opinion when such diverse conditions exist as is the case throughout the United States where brick are used for pavement; but they do believe that the time has arrived when a few cardinal principles should be definitely settled and a uniformity upon certain lines be adopted.

The drawing of specifications for a number of years has furnished a fertile field for theoretical thought, and it has sometimes seemed that those engaged in the work endeavor to get up a plan a little different from any one else.

The members of your committee happen to represent the three states in which more paving brick are made and used than any other in the United States, and have all been

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engaged in the manufacture of this material. Two of them, in addition to being manufacturers, have been contractors for the laying of pavements and all of them interested in having the best possible pavement that can be made from good brick.

With these preliminaries before you (with profuse apologies for any seeming interference with their work to the engineering fraternity) your committee respectfully, but sincerely, submit the following suggestions as embodying the results of their best judgment and experience:

First—For all streets in cities or large towns a concrete foundation of broken stone and cement of not less than six inches in depth shall be constructed with the surface to conform precisely with that of the finished street. Upon this concrete foundation shall be placed not less than two inches of clean sand, entirely free from pebbles. Preceding the laying of the brick upon this cushion at either side and next to the curb, should be placed a board one inch in thickness to the hight of the brick to be set in the street. This board should remain until after the brick are rolled, when it should be displaced and in its stead the place should be filled two-thirds with pitch, the remaining one-third should be filled with sand.

The brick when placed upon this sand cushion should be rolled with a roller not exceeding five tons in weight, and one rolling should succeed another until the brick are brought to an even surface and the sand cushion thoroughly compacted.

Your committee have very decided convictions in regard to the use of the heavy roller and are satisfied that it is almost impossible to secure uniformity in the surface and uniformity of compaction of the cushion by the use of a roller heavier than mentioned. They do not think it necessary and particularly emphasize this, as but few specifications for brick pavement closely adhere to this requirement.

The work thus far being accomplished, no accumulation of dirt should be allowed to remain on the surface of the brick or in the crevices between them preceding the filling of same with a mixture of cement and sand, which shall be in proportion of one to one. This cement filler must be skillfully applied and requires more attention in its minutest detail than any other portion of the construction.

The cement and sand must be thoroughly mixed dry, and kept in continual motion from the time the water is being applied until it is swept thoroughly into the crevices of the pavement. It must be mixed so thin that all interstices are completely and perfectly filled. This done and left absolutely without interference by use or travel until the filler has become thoroughly set, we have our ideal brick street complete in satisfaction, and in durability unquestioned and unmeasured.

In outlying residence streets in our cities, in towns and villages where the travel is lessened from two thousand and over to five hundred and less daily, such communities can enjoy the luxury of a very satisfactory street lasting a lifetime at much less cost. So that where the travel is reduced, four inches of concrete is sufficient, or where gravel can be had at a minimum cost, a foundation of gravel with a road bed properly drained, with sand cushion and sand filler, will be found very satisfactory. In the construction of country roadways a course of good brick laid flat upon a bed of three inches of gravel and sand is very desirable where difficulties to drainage obtain and cheap construction is wished for.

As we have intimated, it is not our purpose to recommend to this convention a specification in detail for the construction of brick streets.

That is scarcely possible to do and make it apply equally well to all the varied conditions with which we meet, but this committee feels that it cannot do better than refer to the paper read before this convention one year ago by Engineer George B. Grimes, as embodying the best details for the construction of brick streets.

These details skillfully applied have furnished conclusive proof of the best and most durable construction that has come under the notice and examination of your committee.

After considerable discussion of the effect of such action the meeting adopted the following resolution:

Whereas, This convention has listened to the report of the committee on construction of brick streets with satisfaction, and fully approves of same, and,

Whereas, The American Society of Municipal Improvements has appointed a committee to act cojointly with a like committee on construction of brick streets from this association, and,

Whereas, A committee of this association known as the testing committee has notified the convention that they will not be ready with a full report before June, 1901, and

Whereas, It is the sense of this association that the best interests of both the buyers and sellers of paving brick will be promoted by the insertion in all contracts for the sale of same a provision requiring that the brick shall be inspected at the maker's works by engineers or other competent persons of high character, who will be disinterested and mutually satisfactory to both buyer and seller.

Be it therefore resolved, That the committee on the construction of brick streets be continued and enlarged to consist of nine members (six additional members to be appointed by the president), whose duty it shall be to arrange a joint meeting of the several above named committees, the duty of the joint committee to be to adopt and issue complete specifications for the construction of brick streets in detail, and the same shall be promulgated by and with the authority of this association, and recommended to all members of the same for adoption and use in their business; and that the members of the joint committee are hereby also requested and instructed to use their best endeavors to bring about the insertion of the provision for inspection at makers' works, as above set forth, of all contracts for paving brick to be hereafter sold by any of the members of this association.

A. N. Talbot, W. K. Eldridge and A. D. Thompson are the committee of the A. S. M. I. referred to.

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Oil for Streets.

A. E. Brock, Trustee of the City of Redlands, reported to the California League of Municipalities his success in the use of oil upon streets:

It has in fact settled the question of dust with us. Two years ago, when we adopted the plan, water was very scarce, and that moved us to try the experiment of using oil. We had not a single complaint from any person in the town in regard to the use of the oil. It has satisfied everybody much better than water, and, what is one of the best features of it is, that when the rainy season comes it protects our roads and keeps them in better condition than would otherwise be the case by putting a coating upon the streets. One objection that was raised to it was its effect on ladies' dresses and bicycles. But all of those objections have been practically settled. There is nothing whatever detrimental in the use of oil on the streets, and the more we use it the more we think of it. There is no doubt that we will continue to use it instead of water. The oil must be heated and must be put on hot. It is applied with a patented machine six feet wide, and on top of it the machine puts a little dust—it works better where there is about an inch of dust on the street. It should be put on in hot weather as it runs better and spreads out. Then in a day or two it can be driven over. At first we applied it on one side of the street and put up barriers so as to keep people off, but now we let them drive over it if they wish. It will stick on the wheels of a wagon for a day, but after that it is not noticed. Three times sprinkling a year will keep the dust down. It is not applicable to an asphalt street, as it would spoil the asphalt.

We paid one year $4,424, including $15 a mile royalty for the use of the machine on a total of eighteen miles of street, and the sprinkled space was eighteen feet wide on some streets and on some twelve feet wide, the sprinkled area being 95,000 square feet.

A poor grade of oil with an asphaltum base is used, costing $1 to $1.25 a barrel. The total cost of the sprinkling for the width of street served was 8 cents a front foot on each side of the street, of which the property-owners cheerfully paid 2 cents.

The only objection to the use of oil in the Berkeley park system was the rank odor, which lasts from four to six weeks.

A Family Eminent in the Asphalt and Coal Tar Industries of America.

So much has been said on the subject of the use of bituminous cements and concretes and so little has been said by those who have taken an active part in their use, that Mr. Fred J. Warren has been requested to write for Municipal Engineering some articles on the subject. His qualifications for the discussion of the subject will certainly make these articles of much interest.

Mr. Warren's special equipment in the matter arises from the fact that he is one of the family of Warrens who first distilled and used coal tar bitumen in the United States, and were among the first importers and refiners of asphalts, and has had long association in business with the best minds devoted to the subject.

Mr. Samuel M. Warren, now of Brookline, Mass., in 1845 was engaged in the business of laying pine tar roofs, and coal tars at that time were the waste products of the gas works. He conceived the idea of using coal tars to mix with pine tar pitches, and almost immediately thereafter used coal tar for saturating dry felt in making roofing paper. The first experiments and use occurred in Cincinnati. Mr. Warren was then a young man, and the opportunities for the development seemed so great that his brothers, John Warren, Cyrus M. Warren, Herbert M. Warren and E. Burgess Warren, successively and almost immediately entered with their brother upon contracting systematically for the largest supplies of tars in the United States. The various brothers controlled at one time the tars produced in Cincinnati, St. Louis, New York City, Philadelphia, Baltimore and Washington. D. C.

To John Warren, who located in Buffalo, N Y., is entitled to the credit for first distilling coal tar and making coal tar pitch; and its immediate substitution for pine tar spread over the United States. Hendricks's Architectural, Engineering and Mechanical Directory of the United States gives names and addresses of over seven thousand concerns now actively engaged in the laying of this kind of roofing. The business was almost immediately so prosperous that out of the revenues Messrs. Cyrus M. Warren and Samuel M. Warren took courses in Harvard college, the latter afterward being professor of organic chemistry in the Massachusetts Institute of Technology, and the author of that part of Dana's work on hydrocarbons which appeared in Dana's work on mineralogy.

When petroleum came on the market the Warrens were among the first distillers in the United States, and Mr. Cyrus M. Warren became recognized as the best authority on the use of bituminous materials and invented the process of fractional distillation of petroleum and coal tar oils, which process has given to the world all the numerous by-products. The commercial growth of the business up to 1870 was phenomenal and all of the best energies were necessarily applied to the commercial development rather than to scientific investigation. In 1870 reverses came and found the Warrens with large contracts for tar, with a falling market and increased competion on the price of tar and manufactured goods. The reverses were so great that in 1876 they were, with the exception of E. Burgess Warren of Philadelphia, in an embarrassed condition.

At this time competition made necessary the development of something new and better, and Cyrus M. Warren invented the as-

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phalt roofing which has so long been manufactured by the Warren Chemical & Manufacturing company, and they became the first large importers and refiners of asphalt in this country.

The early failure of the coal tar bitumens in concrete construction, owing to the price at which they were laid, furnished no incentive for development, and a general view prevailed that concretes in which coal tar bitumens were used were deficient in every respect and should be excluded from all standard specifications. A monopoly in the control of asphalt made it commercially profitable to decry even the best coal

FRED J. WARREN.

tar bitumens and to extend the use of asphalts. Yet it seems to be a fact that the early asphalt pavements were as great failures as the early coal tar pavements.

In recent years the Warrens have played a prominent part in the development of the asphalt pavements of the country. Mr. E. Burgess Warren was one of the organizers and one of the largest stockholders of the Barber Asphalt Paving company, and for many years its vice-president. Cyrus M. Warren was the organizer and the president of the Warren-Scharf Asphalt Paving company, and in the management of this company and of the Warren Chemical and Manufacturing company and other allied interests he was aided by his brothers, sons and nephews, and there have been engaged in the business over twenty-two Warrens.

Mr. Fred J. Warren is one of eight brothers who have given their time to the business and have furnished to the trade the late Jesse Warren, the first general superintendent of the Barber Asphalt Paving company, who continued in that position until his retirement on account of ill health; Henry J. Warren, superintendent of the Barber Asphalt Paving company in Buffalo, N. Y., who has personally superintended over $10,000,000 worth of asphalt paving; George C. Warren, general superintendent of the Warren-Scharf Asphalt Paving company, and Herbert M. Warren, superintendent of the Barber Asphalt company's refinery in Philadelphia. They are all sons of the late Herbert M. Warren, who was the first distiller of coal tar in St. Louis and Philadelphia and who was one of the organizers of the New England Felt Roofing company and the Warren Chemical and Manufacturing company, and was at the time of his death vice-president and active manager of that company.

Mr Fred Warren himself was first connected in the business as clerk and laborer for the Warren Chemical and manufacturing company in their refinery in New York, in 1883, and in 1884 was connected with the laying of Alexander-st. in Rochester, N. Y., the first pavement laid by the Warren-Scharf company. On account of ill health he went West in 1885 and became connected with the Barber Asphalt Paving company as foreman and then as assistant superintendent in St. Joseph, Mo., in 1886. In 1887 and 1888 he was superintendent of that company in St. Joseph, Mo., and Omaha, Neb. In 1889 he was transferred to Chicago as superintendent of the company's business there. On account of ill health he moved to Denver in 1890, where he took an active part in the introduction of asphalt pavements in that city, and had personal supervision of all the pavements laid by the Barber Asphalt Paving company there. In 1892 he was one of the organizers and the manager of the Colorado Paving company, manager of the Colorado Paving company, in which the Barber company was interested. Owing to the distance from Eastern points his company maintained a separate laboratory for the examination and preparation of the pavements. In 1898 on account of the ill health of his wife he returned to Newton, Mass., the place of his birth, and immediately started in laboratory work, and has been following out a line of independent chemical research during the past two years.

Mr. Warren's father died in 1880 before the paving business started to develop, and he and his brothers from necessity put their time upon the practical and construction end of the business, while other branches

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of the Warren family developed the business and financial end. The various brothers have personally superintended the construction of over 30 per cent. of all the asphalt pavements now in use in the United States. The knowledge attained by long family intercourse with those who have given their lives to the development of the bituminous industry of the country and from being familiar in a business way with the best thought of Professor Bowen, Richardson, De Smet, Scharf, Dow, Miller and others, is not generally at the command of writers upon this subject.

Mr. Warren's recent investigations have been largely upon the line of developing new uses for bituminous concretes, and the development of new methods under which improvements can be brought about. He is in no way interested in the use of asphalt for street pavements, and in fact all of the Warrens with a few exceptions have gone out of the business except on the lines above mentioned.

The Venezuelan Asphalt Case in Court

The controversy between the Warner-Quinlan Company and the National Asphalt Company has been submitted to the Venezuelan courts for adjustment. The Warner-Quinlan claimants sent a few workmen on to the lake claimed by the Bermudez company; they were ejected and suit was begun against the Bermudez company before the Bermudez courts. It is the intention of the state department to let the controversy be tried out before the Venezuelan tribunal.

Cost of Cleaning Water Mains.

To the Editor of Municipal Engineering:

Sir—In your magazine for December, page 428, referring to the cost of cleaning water pipes with mechanical scrapers, you quote a statement of mine showing the cost per foot of cleaning different pipes. In each case the cost is put down at cents per lineal foot, while it should be hundredths of cents. As the difference is considerable, I would suggest that it be corrected, as the information contained in your article has attracted considerable attention among water works officials. Yours truly,

F. W. W. DOANE,
City Engineer of Halifax, N. S.

Cost of Municipal Lighting in Massachusetts.

The report of the Massachusetts gas and electric light commissioners for 1900 shows that seventeen towns and cities in the commonwealth own and manage their own lighting plants. The towns and cities are: Belmont, Braintree, Chicopee, Danvers, Hingham, Hudson, Hull, Marblehead, Middleboro, Needham, No. Attleboro, Peabody, Reading, Taunton, Wakefield, Wellesley and Westfield. Three towns, Middleboro, Wakefield and Westfield, furnish gas and electricity, the others electricity only. Belmont, Hingham, Needham and Wellesley have only distributing plants, buying their electricity. The town of Westfield bought the private plant in that town for $150,000 and began to supply June 1, 1900. The total assets of these municipal lighting plants are $1,415,269.95. The maximum number of lamps is 2,027, ranging from 1,200 to 2,000 candle power. The maximum number of incandescent lamps is 38,450.

The cost of municipal lighting is figured by the board as follows: To interest, depreciation and other cost items is added the net cost of operating. The net cost is the difference between the operating expenses and the income from commercial and domestic lighting. Interest is computed at the rate paid on bonds and notes and depreciation at 5 per cent. upon the cost as shown by the books. It will be noticed that the rates secured in most cases are very much less than are obtained elsewhere under private ownership. Belmont has 12 arc and 146 incandescent on moonlight schedule, 5.5 hours in 22.4 days per month. Cost, $121.11 for arc and $30.28 for incandescent per lamp year.

Braintree has 111 incandescent and 94 arcs, run 7.7 hourse, 24.8 days; cost per lamp per year is $22.48 for incandescent and $89.91 for arcs.

Chicopee has 143 arc run 8.7 hours 28.8 days; cost per lamp year is $109.74.

Danvers has 123 arcs, run 5.9 hours, 24.6 days; cost per lamp year is $55.87.

Hingham has 379 lamps of 32 candle power, run 5.2 hours for 25 days; cost per lamp year is $15.86.

Hudson has 25 arcs and 106 incandescent, run 4.8 hours for 28.7 days; cost per lamp year is $22.88 for incandescent and $132.08 for arcs.

Hull has 214 incandescent, run 4.7 hours for 24.6 days; cost per lamp year, $60.18.

Marblehead has eight 30-candle power, ten 16-candle power, 41 25-candle power and 154 arcs, run 8.6 hours 29 days; cost was $17.72 per lamp year for the 30-candle power; $9.42 for the 16-candle power, $14.75 for the 25-candle power and $68.75 for the arcs.

Peabody has 15 lamps of 32 and 50-candle power and 178 arcs, run 10.2 hours, 30.4 days; cost of lamps per year is $27.81 and $43.54 for the incandescent and $73.75 for the arcs.

Reading has 128 arcs run 5.3 hours for 24.1 days; cost per lamp per year is $89.65.

Middleborough has 152 incandescent and 15 arcs, run 4.4 hours for 24.1 days and 13 arcs eight hours for 24.1 days; cost per lamp year is $25.62 for the incandescent and $102.47 and $186.31 for the arcs.

Needham has 380 incandescent, run 4.9 hours for 24.3 days; cost per lamp year is $11.94.

No. Attleboro has 583 incandescent, run

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4.3 hours, 24.2 days; cost per lamp year is $10.96.

Taunton has 206 arcs, run 6.9 hours, 25.9 days; cost per lamp year is $73.12.

Wakefield has 145 arcs, run 4.7 hours, 24.2 days; cost per lamp year is $83.30.

Wellesley has 18 16-candle power lamps run 12.8 hours, 30.4 days, and 535 25-candle power lamps, run five hours, 25.5 days; cost per lamp year is $16.85 for the 16-candle power and $8.63 for the 25-candle power.

Westfield has seven incandescent and 89 arcs, run 5.5 hours, 30 days. Report is for one month only, but it shows a gain on operating account of $488.04 for that time. The town has customers for 12 arcs and 421 incandescent lights, and the development of this municipal enterprise will be watched with great interest.

The prices charged private customers by those municipal plants are low. Belmont, Hudson, Taunton and Wakefield charge a cent an hour; Braintree, 6 mills; Danvers, 5 mills; Hull, 1¾ cents; Middleboro, North Attleboro and Peabody, three-fourths of a cent; Reading, 1½ cents; Westfield, $1 to $1.25 per month.

Municipal lighting plants are contemplated by a large number of towns and cities throughout the state.

City Sustained in Refusal to Permit Erection of Poles.

A decision was rendered by Judge McCann at Dayton, O., March 19, dismissing the application of the Dayton Electric Light company to erect two poles in the southeast corner of Fourth and Main-sts., in front of the Davis office building. Judge McCann held that the plaintiff's right to make the appropriation sought depends not only upon the general consent to use the streets as obtained in its franchise, but also upon consent of the proper authorities to locate its poles and tear up the streets at the points named. The plaintiff did not establish the right to make application inasmuch as the city officials had refused to grant permission to erect the poles and excavate the streets, and a dismissal was decreed.

The city boards decided some time ago that hereafter no poles shall be placed in the district bounded between the river, Sixth-st. and Webster-st. The outcome of the case will, therefore, prove of interest to the city, establishing ash it does a precedent in the matter of erecting poles in the underground district.

Appropriations for Public Work in Washington.

The District of Columbia appropriation bil passed by congress appropriates $500,000 to continue work during the next fiscal year on a filtration plant for Washington; $162,000 for the completion of the Washington aqueduct tunnel and the Howard University reservoir; $375,000 for a sewage disposal pumping station; $340,000 for new sewers. The bill to permit the laying of a single track for an electric railroad across the aqueduct bridge did not pass.

Destruction of Landmarks.

A circular to commissioners of highways has been issued by County Surveyor W. M. Hay of DeKalb county, Illinois, calling their attention to the frequent displacement and complete removal of stones set in roads to mark sections and other land corners. He requests their co-operation in impressing the value of their landmarks upon those who do the actual work of road repair, especially those running road graders and scrapers, suggesting that the commissioners hold them responsible for such destruction of marks. The destruction of corners makes additional work for surveyors and additional fees so that Mr. Hay cannot be accused of self-interest in issuing this circular. Other county surveyors may arouse some interest in the matter by similar action. Doubtless Mr. Hay will send copies of the circular to any one interested if he is addressed at Sandwich.

Engineers' Headquarters at Pan-American Exposition.

The Engineers' Society of Western New York decided, at a meeting held March 5, to invite all the engineers' societies of the two Americas to partake of its hospitality during the Pan-American exposition. A bureau of information and postoffice will be provided the visitors in the Ellicott square headquarters.

A Million Wanted for Good Roads in New York.

At the recent good roads convention held in Albany, N. Y., a resolution was adopted asking the legislature to appropriate $1,000,000 for road construction during the next fiscal year. The convention was composed of nearly two hundred supervisors, sent as delegates from the different counties of the state. State Engineer Bond stated that in the course of the last year fourteen roads had been built in nine counties, with a total length of 35.17 miles, at a cost of $226,213.04. Also that nine roads in five counties are now under course of construction, with a total length of 18.41 miles, at a cost of $162,952.82.

The state appropriation last year was far below the amount appropriated by the counties thus resulting in absolutely no road improvement in certain parts of the state, where the taxpayers are willing to pay their one-half.

The discussion at the convention indicated that it was the prevailing opinion that roads leading out of cities should be macadamized with a traprock surface, which

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costs on an average of $7,977, and that side roads need only be built of dirt at an average cost of $2,053.

Indiana Improvement Laws of 1901.

The Indiana Legislature enacted new laws pertaining to street improvements and assessments, sewers, gravel roads, etc., during the recent session as follows:

—Street Improvements—

House act No. 35 expressly repeals the "Barrett law" so far as it applies to cities organized under the general law, and substitutes another mode of making street, alley and sewer improvements in such cities. It requires that the assessment of benefits against any land benefited by such an improvement shall be made on the basis of the special benefits peculiar to the property assessed, as distinguished from general benefits to the city at large, and that the assessment shall be made after notice to the property-owner, and after he has had an opportunity to be heard. An appeal from such assessment lies to the Circuit Court, and the assessments as finally determined shall be collectible in ten equal annual installments, with interest at 5 per cent., in the same way that taxes are collected. Bonds may be issued to anticipate the collection of such assessments.

—Street Assessments—

House act No. 336 amends acts 1890, page 58, by which it was provided that no action should be brought for the enforcement of any lien or assessment for public improvements until after ten day's notice should have been given the owner of the land of the assessment and of the amount due, with interest, and where the owner has executed a waiver or contract entitling him to pay his assessments in installments under the provisions of the Barrett law. The act contains an emergency clause.

—Sewers—

Senate act No. 124 authorizes any incorporated town in the state to build sewers or a system of sewers for sanitary or drainage purposes within the corporate limits of the town, and outlets to any neighboring stream or water course at the expense of the property benefited thereby, or at the expense of the town. After the board has adopted resolutions giving a general description of the work intended, with its beginning, route and terminus, and has caused it to be surveyed, it shall cause notice to be given by publication or posting of the time of hearing the report of the engineer. A two-thirds vote of the board is necessary to determine that the proposed work is of public utility, and to adopt the report. An appeal lies from the board to the circuit court. When the work is determined on it is to be done by contract. The act contains an emergency clause.

House act No. 287 is supplemental to acts of 1895, page 190, on the subject of sewers in cities organized under the general law. It provides that the common council of any city or board of trustees of any town shall have power to construct and maintain sewers along any street or alley or part thereof, or along or across any lots, or the right-of-way of any railroad or electric or traction road within such city or town, and shall be the sole judges of the necessity or utility of such sewer. They receive power to condemn any lot or part of a lot or any unplatted lands or the right-of-way of other lands, of any railroad, person or corporation, either within or without the corporate limits of the town or city. The act contains an emergency clause.

—Gravel Roads—

Senate act No. 53 makes the board of commissioners of each county a board of directors for all free gravel, macadam and free turnpike roads in such county, and imposes on them the duty of dividing such roads into three districts as nearly equal as possible, one of which shall be taken charge of by each commissioner. Superintendents for such roads are to be appointed on the basis of one superintendent for not less than ten miles nor more than fifteen miles of road, who shall have charge of keeping such road in repair under rules adopted by the board. Provision is also made for condemning materials to use in repairing such roads by proceedings before the board of commissioners subject to an appeal to the circuit court.

House act No. 221 exempts certain gravel roads of Randolph county from the operation of act 1899, page 26, by which the issue of bonds for the construction of free gravel or macadamized roads was limited to 4 per cent. of the total assessed taxable valuation of the property of the township or townships in which such road might be located.

Senate act No. 134 provides for the construction and maintenance of free gravel roads by the county commissioners of any county upon the petition of fifty freeholders who are voters of the township or townships in which the road is to be located. The act applies to townships containing cities, if such cities have less than 30,000 inhabitants.

A Chicago Pavement Fire.

A half block of pavement on Halsted-st., Chicago, was set on fire Feb. 28 through a peculiar circumstance. An oil tank was wrecked by a trolley car, the oil flooding the street pavement. Another electric car came along and a spark ignited the gas from the fluid, the flames spreading rapidly. The car which caused the original trouble was blocked by the wrecked wagon and, being unable to escape, was burned to

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the wheels. The flames spread to a store, burning the woodwork and ruining the plate glass windows. The arrival of the fire department saved other property by confining the burning oil to the middle of the street, where it burnt itself out. All of the windows on both sides of the street for half a block were shattered and the paint on the buildings ruined. The loss was $4,000.

Supreme Court Sustains Right of Illinois Cities to Change Water Rates.

The United States Supreme Court rendered a decision March 26 in favor of the city of Chicago in an issue where the city sought to reduce rates for service and the Rogers Park Water Company to maintain their own figures. The decision affects the water systems of Freeport, Danville and Rogers Park. In each case the water companies contended that the law of 1872 and other subsequent acts authorizing contracts for water supply for thirty years, included the right to fix rates for that time and that the rate once fixed could not be changed. The Illinois supreme court sustained the municipalities in each case, holding an ordinance reducing the price of water to be valid. The United States Supreme Court confirms the decision of the Illinois Supreme Court.

Court Declares Proposed Chattanooga Water Rates Unreasonable.

A decision was handed down Feb. 23 by Judge Clark in the United States district court of Tennessee, in which he held that the ordinance passed by the city council of Chattanooga in 1897, providing for what they believed was a reasonable tariff of water rates, is invalid. In the opinion of the court the rates provided are unreasonable. Judge Clark holds that the city may regulate water rates, but the regulation must not be such as to jeopardize the investment of the water corporation, which is entitled to a reasonable profit on its investment.

A Wisconsin Court Declares Minimum Meter Water Rate Invalid.

A decision was handed down by Judge Kirwan, in the Circuit Court of Manitowoc, Wis., March 4, in the case of Henry Vits vs. the Manitowoc Water Works company. The plaintiff had a meter and refused to pay for more water than was actually used. The company shut off the water and the plaintiff brought suit to compel the service and for damages. The court sustained the plaintiff, holding that the consumer is liable for only actual consumption where a meter is used, even though a minimum rate be stated in the franchise given the company. The decision affects hundreds of patrons in the city. The minimum rate is $5, which the company insists upon collecting regardless of the amount used according to a meter. Action will probably be taken by a number of patrons to recover. The company will appeal.

Trouble Again Reported with Ashland Water Supply.

An analysis of sand taken from the filter used by the Ashland Water company, Ashland, Wis., was made by Dr. H. L. Russell of the University of Wisconsin recently. Dr. Russell said that white rats were inoculated with broth cultures made from the respective samples of sand. The rats inoculated with scraped sand died in twenty-four hours. An examination of the filters at the pump house of the water company revealed the fact that the sand which is used to purify the water has not been changed in three years. The intake pipe has its opening immediately approximate to a point where the main sewers empty. A typhoid fever epidemic has existed in Ashland for three months, resulting in twenty-two deaths. From Jan. 1, 1901, to Feb. 27 there have been 283 cases of typhoid fever in the city, and the contagion is not decreasing.

Proceedings have been begun in the circuit court for the purpose of recalling the company's franchise.

Hempstead Special Election for Water and Light Plants Illegal.

The New York supreme court decided that the special election held last October by the village of Hempstead for the purpose of raising $100,000 for purchasing or contracting municipal water works and electric light plants was illegal. Judge Garrettson, who handed down the opinion, contends that the question of light and water plants should have been presented to the voters separately, and not together, as they have been at each of the three previous special elections held for this purpose. Of these elections two have been held illegal because they had not been advertised the specified number of days required by law, and the question of water and electric lights was voted down the third time. Another special election will be necessary now if the village still desires municipal ownership.

Who Shall Operate the Municipal Lighting Plant in Columbus, O.

A decision was rendered by Judge Williams, March 11, in a suit brought against the city of Columbus, O., by Linas B. Kauffman, director of public improvements, and others, to compel the city to continue the operation of the electric light plant. Judge Williams said the question of issue was the respective powers of Linas B. Kauffman and the board of trustees of the electric works of Columbus. The ordinance passed by council authorizing the issue of $68,000 bonds, also authorized the director of pub-

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improvements to establish an electric light plant. This was done and the plant was placed in operation and continued until July 5, 1900, when Director Kauffman discontinued the operation of the plant because sufficient funds had not been provided. A board of trustees was then appointed. Judge Williams said that the charter law clearly provided that the director of public improvements shall have supervision and control of the lighting of streets. The amendment of 1898, empowering the city councils to purchase or erect electric light plants, did not affect or qualify the authority of the director of public improvements, and for this reason he could not turn the plant over to the trustees selected by the city council. The amendment of 1898 did not apply to electric light plants then in operation. The pleadings show that the city council failed to provide funds. But for this fact, a mandatory order to the director of public improvements commanding the director of public improvements to operate the electric light, would be warranted by the circumstances of the case. If the council has not, by a vote of three-fourths of all the members elected thereto, waived the exaction of any liability from the bondsmen of Kauffman for debts contracted by him beyond the amount appropriated, he cannot be compelled to operate the plant.

Engineer Brings Suit for Libel.

Suit was filed against the members of the water board of Lynn, Mass., March 4 by Charles W. Gay, former city engineer, for libel. Mr. Gay took exception to a statement of the water board regarding work he had done for it. The statement relates to a plan on file at the office of the water board, bearing the following title:

A hydrographic map of the territory draining into Saugus river prepared from a trigonometric survey and authentic compilation. C. W. Gay, C. E., Lynn, Mass., **1885.**

The statement is as follows:

The only plan that the water board ever had of the water sheds of the Saugus river was made in 1885, for which the city paid the sum of $568, and besides showing the water sheds, it showed a table of the area of those water sheds. According to the figures on that plan the area of the water sheds above Howlett's dam, upon which the city paid water damages for diverting the water, is 15.322 square miles, while the true area, as calculated from the same plan, is only 10.868 square miles. By reason of this error of this plan, the city has paid water damages on 15.322 square miles when damages should **have been paid on only 10,868 square miles.**

Mr. Gay demanded a public retraction, which the board did not make.

Individual suits are filed against the five members of the board, W. B. Littlefield, president; James Burns, S. W. Dearborn, Thomas T. Nichols and Charles E. Sprague.

Bricks of Bridewell Manufacture Recommended for Chicago.

A plan has been recommended by L. E. McGann, commissioner of public works at Chicago, which provides for the use of Bridewell bricks for city sewers. He estimates that by increasing the capacity of the plant at the house of correction, 8,000,000 of the 20,000,000 bricks required this year for sewer construction can be furnished at a rate from $1 to $2 less per 1,000 than the city is now paying. Plans are being prepared for enlarging the size of the Bridewell plant.

A Denver Storm Sewer Assessment Illegal.

The Colorado court of appeals rendered a decision March 11 in a suit instituted by tax-payers in the Broadway storm sewer district against the city of Denver, Col., to annul the assessment ordered by the city against the real estate of the plaintiffs for the construction of the storm sewer. It was alleged that the sewer enactment was unconstitutional because it was improperly advertised by the board of public works. An injunction was asked for in the district court restraining the city from enforcing the tax, which was denied. An appeal was taken with the result that Judge Thompson reversed the judgment of the lower court, holding that the entire assessment was illegal.

Riparian Rights Not of the Nature of Franchise.

The New York Supreme Court has rendered a decision in the case of the Niagara Falls Hydraulic Power & Manufacturing company, which brought suit to secure a reduction of valuation of their property for purposes of taxation. The company sought to reduce the assessor's valuation from $625,000 to $337,000 on the construction that its right to take water for the development of power was in the nature of a franchise and therefore not taxable. Judge Childs of the Supreme Court decided that "the relator's right to the use of the water arises from their ownership of riparian rights; that is to say, its ownership of real property which is subject to tax." He also ruled that "the assessment of the said property for the year 1900 in question shall not be reduced, and that the relator's writ should be quashed and set aside with costs to the defendants.

The decision creates a precedent for the valuation of riparian rights after works for the development of power have been built.

Award of Baltimore Garbage Contract Sustained.

A decision was rendered by Judge Ritchie, of the Circuit Court of Baltimore, Md., March 8, in the suit of Roscoe M. Packard against Samuel A. Rice. Mr. Packard, as a

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tax-payer, instituted suit to prevent the award of a contract to the defendant for collecting garbage and other refuse in Baltimore for ten years from June 1, 1901. Mr. Packard alleged that the contract was awarded to Mr. Rice on a plan submitted on Nov. 24, 1900, although the bids were opened three days before that date; that Mr. Rice had no right to use the plan proposed by him, which is patented; that the bids submitted by Mr. Rice and Michael F. Horner were identical and showed unmistakable signs of having been prepared by the same person; that the American Contracting and Mfg. Company should have been awarded the contract as the lowest responsible bidder in accordance with the specifications.

Judge Ritchie finds that Mr. Rice's bid is in proper form and that his failure to file the plan in question is not a valid objection to his bid.

Technical Meetings.

The annual convention of the National Electric Light Association will be held at Niagara Falls, N. Y., May 21 to 26.

The 151st meeting of the American Institute of Electrical Engineers was held in New York City Feb. 28. Wm. J. Hammer delivered a lecture upon "Important European Electrical and Engineering Developments at the Close of the Nineteenth Century."

At a meeting of the Engineers' Club, Columbus, O., March 2, Assistant City Engineer George M. Lilly spoke on "Sewer Maintenance in Columbus."

The annual meeting of the Association of Ontario Land Surveyors was held at Toronto, Ont., Feb. 26, 27 and 28. The program included the following; "Surveys and Plans for Municipalities," H. J. Bowman of Berlin; "Topographic Photography," J. N. Wallace of Hamilton. Officers were elected as follows: President, James Dickson, Fenton Falls; vice-president, W. R. Aylsworth, Belleville; secretary-treasurer, Villiers Sanky, Toronto.

The Union Electrical Contractors' Association of New York state have decided to issue a call for a meeting at the Builders' Exchange building in Buffalo, July 17, for the purpose of forming a National Electrical Contractors' association.

Cost of Making Portland Cement.

In discussing the materials for making cement, which are available on the Pacific coast, Prof. I. C. Russell says:

"The cost of a Portland cement plant in Michigan which is capable of producing 1,000 barrels of cement per day is said to range from about $330,000 to $350,000. A smaller plant than this is not considered economical. The cost of making a barrel of cement is variously stated, but it is probably about $1 per barrel in a mill that turns out 1,000 barrels a day. The marl used in Michigan does not require crushing. If limestone is used, as it would have to be in Oregon, it must be ground as fine as flour, which would make the expense of production greater than in Michigan."

Prof. R. C. Carpenter makes an estimate a few cents less, and shows that the greater the capacity the less the cost per barrel.

Mr. A. Hugo Cederberg, in describing a plant of his design, which is very nearly automatic and whose power transmission is by electricity, gives a detailed estimate of the actual mill cost of a barrel of cement when the mill is running at the rate of 2,000 barrels a day as follows:

Under proper management the cost per barrel at the rate of 2,000 barrels in this mill should be:

Quarrying	4.8 cents
Conveying to crushers	1.1 cents
Crushing	1.1 cents
Limestone crushed	6.6 cents
Mixing and drying	2.1 cents
Rawstone grinding	0.5 cents
Burning	18.1 cents
Coal grinding conveyor	1.3 cents
Clinker grinding	6.1 cents
Packing and loading	3.3 cents
Steam producing	5.9 cents
Generating power	1.7 cents
Office and general expense	2.5 cents
Analyzing expenses	0.6 cents
Total manufacturing cost	55.7 cents

These figures give a very large margin for repaires and accidents, etc., etc., amounting to nearly 3 cents per barrel.

Interest on cost and depreciation of plant must be added to this figure, and the cost of selling must be added to obtain the lowest price at which the cement can be sold without loss. This mill uses the dry grinding process of preparing the ordinary limestone and cement rock of the Pennsylvania cement region and the rotary kiln for burning.

The advantage of large capacity is shown from the reports of the German cement dividends, factories making 200 to 1,000 barrels a day declaring 3 to 10 per cent. dividends in 1899, while those making 1,500 to 3,000 barrels a day declared 15 to 40 per cent. dividends.

Gleanings from Municipal Reports.

Pawtucket, R. I., is a city with a population of 39,000. It owns a water works system which has cost $1,840,000. The receipts for the last fiscal year were $188,489.03, the expenditures for maintenance were $102,468.94, to sinking fund account $86,020.09. The city appropriated $20,000 for new construction, of which $19,681.14 was expended. Of the receipts $17,960 were from hydrant rentals of the various districts served the works, $2,045 for watering streets and $2,601 for other public purposes. Of the maintenance expenses $51,413.38 was for interest paid, the indebtedness being about

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$1,300,000. A new filter is needed. The highway department expended $95,202.36, half being for maintenance, one-sixth on account of Main street widening, $7,028.47 for curbing and the remainder in sums ranging from $200 to $4,000 on various streets. The Sewer Department spent $36,415.61, about $27,000 for general construction and $9,500 for maintenance. Experiments on sewage purification are in progress, part of the sewage having been purified somewhat by filtration since 1894. Experiments on the septic tank show that 41.5 per cent. of the organic matter in the sewage is removed in septic tank, leaving a total residue on evaporation of 1.868 cubic yards per million gallons there deposited. Of this amount 0.878 cubic yards is destroyed by the septic tank, leaving 0.99 cubic yards per million gallons of organic and mineral matter to be removed by hand, at a cost of $0.459 per cubic yard, or $0.463 per million gallons of sewage. Experiments on bacterial filters are in progress.

The specifications under which the city of Garrett let the contract in March for paving Randolph street should secure a good and durable pavement even though the cheapest of the alternative foundations is used. See figures for successful bid on another page.

Personal Notes.

George Beck has been elected city clerk at Goshen, Ind.

James J. Sheehan has been elected city engineer at Everett.

Dr. D. C. Hawley has been elected mayor of Burlington, Vt.

Harry H. Lane has been elected mayor at Peekskill, N. Y.

Julius F. Frehsee has been appointed city engineer at Lockport, N. Y.

Daniel O. Frost has been elected water commissioner at Gloucester, Mass.

Prof. D. J. McAdam has been elected engineer of East Washington borough, Washington, Pa.

S. Cameron Corson has been re-elected borough engineer for the ensuing year at Norristown, Pa.

Lieut. G. W. Langdon has been appointed superintendent of the street department at Newburyport, Mass.

Edward H. Smith has been elected city engineer, and Stephen W. Dearborn water commissioner at Lynn, Mass.

W. E. Mott has been promoted to assistant professor in the College of Civil Engineering at Cornell University, Ithaca, N. Y.

W. Scott Matlack of Mt. Holly, Pa., has been appointed superintendent of the water and sewerage systems at Freehold, Pa.

Walter S. Reed has been appointed to fill the vacancy caused by the resignation of Mayor Benjamin P. Morris, of Long Branch.

Mr. Paul Doty has given up his position with the Grand Rapids Gas company, to accept that of general manager of the Detroit City Gas company.

Philip J. O'Connell was elected mayor at Worcester, Mass., in the special election called to settle the dispute resulting from the regular election, when a tie vote was cast for that office.

T. C. Turner has been elected city engineer at Oakland, Cal.

Edward H. Smith has been appointed city engineer at Lynn, Mass.

Abel H. Clark was appointed water commissioner March 18 at Auburn, N. Y.

George M. Fernald has been reappointed commissioner of public works at Portland, Me.

Abel H. Clark has been elected water commissioner at Auburn, N. Y., to succeed Sidney J. Westfall.

John W. Ellis, M. Am. Soc. C. E., has been elected president and manager of the Providence Gas company, at Providence, R. I.

Henderson W. Knott, chief engineer of the Imperial Electrical Supplies, Ltd., of London, is visiting the United States.

E. C. Slater, who was recently appointed city engineer at Conneaut, O., has resigned to accept a government position at Watervliet Arsenal, Troy, N. Y.

Howard G. Taylor of Portland, Me., has been appointed first assistant to George D. Snyder, city engineer at Williamsport, Pa.

Winslow T. Webber has established an office in the Tibbets block, Gloucester, Mass., for the practice of civil engineering.

Frank Hoge, C. E., Wheeling, W. Va., died suddenly March 16, aged 60 years. Mr. Hoge planned and built the 198-ft. stone arch bridge over Wheeling creek.

E. A. Kemmler was promoted March 18 to the vacancy in the city engineer's department at Columbus, O., caused by the resignation of John P. Force, second assistant engineer.

Horace Andrews, former city engineer of Albany, N. Y., read a paper March 19 before the Albany Institute and Historical and Art Society on the subject of "The Nomenclature of Albany's Streets."

Joseph P. Ord, who recently resigned as vice-president of the General Electric company, has become permanently connected with the firm of J. P. Morgan & Co.

Gilbert Wilkes, head of a firm of electrical and mechanical engineers, Denver, Col., died in that city March 11.

John P. Force, second assistant city engineer at Columbus, O., has resigned his position and will devote his attention to municipal engineering.

H. H. Windsor has resigned his position on managing editor of the Street Railway Review of Chicago, and has been succeeded by Daniel Royse, who has been associated with him for the last four years. Mr. Windsor will engage in organizing and constructing electric railways.

S. Whinery, M. Am. Soc. C. E., Mem. M. Am. Soc. M. E., M. Am. Inst. Min. E., recently acting president of the Warren-Scharf Asphalt company, has opened an office as consulting engineer, at 95-97 Liberty-st. New York ,City. He will devote his attention to municipal work, especially street paving, the development of water-power and of industrial enterprises, and railroads existing or prospective.

Charles F. Loweth, M. Am. Soc. C. E. of St. Paul, Minn., has been appointed engineer and superintendent of bridges and buildings

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of the Chicago, Milwaukee & St. Paul railway, with offices at Chicago. Mr. Loweth succeeds Onward Bates, M. Am. Soc. C. E., who resigned to enter private business.

W. B. Patton was elected city engineer of Duluth, Minn., on March 12. Mr. Patton has filled the position of city engineer under several previous administrations. During his last incumbency of the position in 1895-6-7, he designed and began the erection of the municipal water plant.

A. H. Lighthall, C. E., was found dead in his room in the Bartholdi Hotel, New York City, Feb. 26. Mr. Lighthall was best known as a railway engineer and inventor, although he constructed sewerage systems for Mobile, Ala., and New Orleans, and at the time of his death was engaged in remodeling these systems. Mr. Lighthall when found held a check in his hand for $10,000 for a patent which he had recently sold to a railroad company.

A. J. Hammond, recently assistant engineer on the Vandalia lines, has accepted an appointment as city engineer of South Bend, Ind., the first under the new charter. Mr. Hammond comes well prepared for the work from several years' experience as city engineer of Frankfort, Ind., and other experience in sewerage and water works as well as in the construction and repair problems in railroad maintenace of way. He is a graduate of Rose Polytechnic Institute and a past president of the Indiana Engineers' Society.

Mr. Onward Bates, long engineer and superintendent of buildings on the C., M. & St. P. railroad, has resigned and is succeeded by Mr. Charles F. Loweth, C. E. Mr. Bates's experience of over thirty years has almost all been in the departments of bridges and buildings of such constructions and companies as the St. Charles bridge over the Missouri river, Eads bridge over the Mississippi river at St. Louis, Baltimore Bridge company, Cincinnati Southern railway, Edge Moor Iron company of Wilmington, Del., Pittsburg Bridge company. Since Feb. 1, 1888, he has been engineer and superintendent of bridges and buildings of the C., M. & St. P. railway, where he had full charge of design, construction and maintenance of bridges, culverts, buildings, water supply, etc., on a system growing since that time from 5,700 to 6,500 miles in length, building more than eleven miles of iron and steel bridges, and the culverts which made it possible to replace forty-four miles of wooden bridges with earth embankments. It has been the policy of the C., M. & St. P. railway to do all work on, over or under its tracks with its own employes, and the work of the bridge and building department being done by day labor, so that Mr. Bates has been at the head of a working organization with a pay-roll which has at times exceeded $100,000 a month. Mr. Bates holds an honorary degree of civil engineer from the University of Wisconsin, and is a member of the Western Society of Engineers, the American Society of Civil Engineers, the American Railway Engineering and Maintenance of Way Society, the Institution of Civil Engineering and of other technical associations. Mr. Bates expects to engage in private practice as an engineer and contractor with W. A. Rogers, recently engineer of permanent construction of the same railroad under the firm name of Bates & Rogers, with offices in Chicago.

MACHINERY AND TRADE.

A Statement from the New York Continental Jewell Filtration Company.

We are in receipt of a letter from the New York Continental Jewell Filtration company of New York City, with a request for publication, containing the following statement:

To Whom It May Concern:

It having frequently come to my notice that Ira H. Jewell, my son, is representing himself as identified with the 'Jewell filter,' manufactured by the O. H. Jewell Filter company, and with myself as financial backer, I find it necessary to publicly state that the said Ira H. Jewell has had no connection whatever with the O. H. Jewell Filter company since selling his stock interest therein over one year ago, and never with its successors in the filter business, the New York Continental Filtration company; nor has he any business relations with me of any description.

Any statements of his, or those of his representatives, that he is authorized to do business of any sort for the O. H. Jewell Filter company, or its successors as above, are unqualifiedly false and without foundation; and if made, are done so with the deliberate intention to deceive. Respectfully yours, O. H. JEWELL,

Western General Manager New York Continental Filtration Company.

We would call the attention of those interested in filters to the name of Ira H. Jewell's company, the I. H. Jewell Filter company, as it is so much like the O. H. Jewell Filter company as to be misleading. The I. H. Jewell Filter company has no connection whatever with the O. H. Jewell Filter company or the New York Continental Jewell Filtration company, nor with the Standard Jewell Filter, which we manufacture and sell, and the patents of which we control. Yours very truly,

N. Y. CONTINENTAL JEWELL FIL. CO.

The First Central Station Heating Plant on the Smead System.

The central station heating plant at Washington Court House, Ohio, which is now practically completed, is constructed by the Central Station Heating company of Cincinnati for the Washington-Smead hot water lines. The work was commenced Nov. 26, 1900, by Mr. Isaac D. Smead, assisted by his son, Burton A. Smead. The boiler constructed for this plant under Mr. Smead's stand pipe system, as a whole, is

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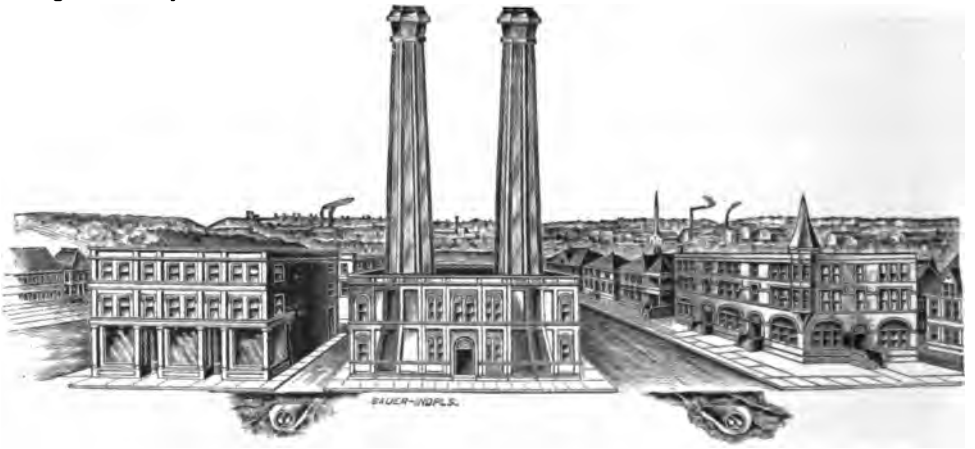
the largest boiler ever constructed. The advantages of central station heating are stated in a leading article in this number of Municipal Engineering, and a number of views of the Washington, O., plant are used as illustrations. The view on this page shows the standard design for a station for the distribution of heat and indicates the advantages of central location and concentration of fuel consumption in a large central plant which can easily be made smokeless.

The Washington, O., plant has a capacity for heating 300 houses and can be easily increased in size by adding boiler units of similar sizes.

There are some advantages in restricting the duty of a plant to heating only of which full advantage is taken in the design of this system.



SMEAD STAND PIPE SYSTEM AND HOT WATER LINES. DESING FOR CENTRAL HEATING STATION.

Trade Publications.

The Pittsburg Filter Mfg., Co., Pittsburg, Pa., has issued an illustrated circular descriptive of the Ideal system of water purification, consisting of a plant for the purification of hot water for boilers, etc., acting continuously, and one for the purification of cold water, for laundries, hotels, etc., acting intermittently.

The Studebaker Bros. Mfg. Co., of South Bend, Ind., issue a Farmers' Almanac with the usual calendars and much information usually found only in more pretentious publications, in addition to advertisements of their goods.

Ten Years Practical Experience with Natural Rock Asphalt and its Products is the title of a booklet issued by the W. S. P. Shields Paving and Construction Co., 705-706 Witherspoon Building, Philadelphia, Pa., giving statements of the advantages of asphalt mastic for sidewalks, floors, roofs, and many other uses, and lists of users. Its use for street paving is emphasized, as well as on viaducts and bridges, and in foundations for machinery, and other special purposes.

A very attractive Twentieth Century number of Power and Transmission has been issued showing among other items of interest some very excellent halftones of a quarter-Twist rope drive of the Dodge Manufacturing company of Mishawaka, Ind. Some arrangements for the comfort and advancement of employes of manufacturing establishments are also shown and their use described. Hints on the proper installation of machinery are numerous and valuable. The publication is very creditable and shows enterprise and progress. This number is volume 16, number 2. It is issued quarterly and is an attractive method of presenting information regarding the products of the firm and their application in manufacturing plants.

Trade Notes.

ASPHALT.

The city of Detroit, Mich., has placed an order with Hetherington & Berner of Indianapolis, Ind., for a municipal asphalt plant, to be in working order by May 1.

The Interstate Paving company has been organized with a capital of $1,000,000 to lay and supply Obispo asphalt in the eastern states for street paving and other purposes. The principal office is located at present in Utica, N. Y. Charles S. Williams, Utica, is president and treasurer and W. M. Van Auken of Utica is vice-president and secretary. The company will compete with the asphalt trust. Mr. Williams was formerly president and Mr. Van Auken general counsel of the Utica paving company and the Alcatraz Construction company, which were absorbed by the trust. The company bid recently at Rome, N. Y.

BRICK.

The large plant of the Buckeye Pressed Brick company, at Roseville, O., has been transferred to the Ohio Pressed Brick company, a branch of the Hydraulic Brick company of St. Louis. The syndicate operates 29 plants.

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William Wirt Clarke & Son, 115 Gay-st., south, Baltimore, Md., has been awarded the contract for supplying vitrified street paving brick and terra cotta culvert pipe to the city engineer's department of Baltimore for the year 1901.

CEMENT.

The Reading Cement Co., near Evansville, Pa., is installing new engines, boilers, kilns and grinding machinery.

It is believed that a large cement plant will be erected near Orangeville, Barry county, Michigan, where extensive marl deposits have been located.

The Pyramid Cement company has been incorporated and a Portland cement plant will be established between Albion and Jackson, Mich. Detroit capitalists are interested.

Work on the proposed plant of the Standard Portland Cement company, recently organized, will begin as soon as spring opens. The plant will be located at Hamburg Junction, on Zukey Lake, Mich.

The plant of the Great Northern Portland Cement Company, at Baldwin, Mich., will probably be completed by June 1 The plant will ultimately have a capacity of 12,000 barrels a day and will occupy seventeen acres. The company owns 4,000 acres of marl land and 1,500 acres of clay.

The Chickamauga Cement Co., New Haven, Conn., has been incorporated by Samuel L. Bronson and Levi N. Blydenburg, of New Haven; Uriah Cummings and Homer S. Cummings, of Stamford. The company has completed a large plant at Rossville, Ga.

The syndicate of Detroit and Chicago capitalists that recently bought a large tract of land at Milltown, Ind., thirty miles west of New Albany, will establish a mill for the manufacture of Portland cement. The enterprise will represent an investment of $600,000 and the plant will have a capacity of 3,500 barrels.

The plant of the Southern Cement company, at North Birmingham, Ala., is completed and the manufacture of Portland and hydraulic cement has begun. The officers of the company are: President, Caldwell Bradshaw; vice-president and superintendent, Terrence C. Curtin; secretary and treasurer, T. M. Bradley.

William Wirt Clarke & Son, 115 Gay-st., South Baltimore, Md. have been awarded the contract for all the Portland cement that will be required at the Brooklyn Navy Yard for the year 1901. The company is now supplying Portland cement for the United States Government Printing Office in Washington, which will not be completed until some time next year.

The William G. Hartranft Cement company of Philadelphia is insuring that the names of the cements for which it is the sales agent shall be constantly before the eyes of engineers, users of and dealers in cement, by sending out line dates of convenient design on the heads of which are printed fac similes of the labels of the Phoenix and Old Dominion brands of Portland cement, the sale of which this company controls.

HOT WATER HEATING PLANTS.

The board of control, Cherokee, Ia., is considering the question of installing a hot water plant.

STREET LIGHTING.

The Cincinnati Gas Light company will absorb the Cincinnati Edison Electric company and all the other smaller electric lighting companies in Cincinnati.

Pittsburg capitalists are largely interested in the Ohio Valley Electric Light, Heat & Power company, which was organized in that city for the purpose of building and operating a municipal and commercial electric light plant in Steubenville, O.

A company has been organized at Niles, Mich., to manufacture electric lamps and transformers and other electrical specialties. The company will erect a two-story building. F. W. Stillwagon, W. H. Pritchard and P. J. Pritchard of Niles are interested.

J. Holt Gates & Co., Chicago, has just installed a 250 horse power Electric Power Plant for the Brower building, Chicago, in connection with Vilter Corliss engine. A great many of the electrical people of Chicago will occupy this building, and it will be a representative plant. This firm has been very busy this winter.

The Wiswell-Pritchard Electric Mfg. company, Niles, O., has been incorporated to manufacture electric lamps, transformers and other electrical supplies. The incorporators are: P. J. Pritchard, W. H. Pritchard and F. W. Stillwagon of Niles and Henry W. Wiswell and Chas. M. Wilkins of Warren.

The municipality of Newberry, Mich., has just started a 1,200 light Warren Inductor Alternator direct connected to an Erie Ball engine at a speed of 300 revolutions per minute for the unit. The council has been very much pleased with the outfit, which also operates two street lighting circuits of forty 50 candle power incandescent lamps each. The prominent feature of this plant is that there is not an oil cup on the outfit, and it is almost entirely automatic. The apparatus was furnished by J. Holt Gates & Co., Monadnock building, Chicago.

Newly incorporated companies: People's Electric Light & Power company, Kansas City, Mo.; Radiant Incandescent Light company, Rochester, N. Y.; West Nashville Power & Light company, Nashville, Tenn.; Georgetown Electric Light company, Ltd., Glen Williams, Ont., Canada; Glen Fay Power company, Ltd., Ottawa, Canada; Attica Water, Gas & Electric company, Attica, N. Y.; Bucyrus Gas & Electric Light company, Bucyrus, O.; Franklin Electric company, Davenport, Ia.; the Electric company, Warrenton, Mo.; Light, Heat, Transit & Public Service company., Fargo, N. D.

SEWER PIPE.

The Milwaukee Sewer Pipe & Supply Co., Milwaukee, Wis., was organized March 13

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as the successor to the Master Plumbers' Sewer Pipe Association. Officers were elected as follows: President, H. C. Apel; vice-president, E. C. Kuetmeyer; treasurer, W. E. Goodman; secretary, I. H. Plumb. Directors—The officers and Charles Gezelschap, Henry Dearsley and F. R. Deugel.

The Ogden Sewer Pipe & Clay Co., Ogden, Utah, was incorporated March 12 to manufacture and sell drain tile, sewer and water pipe, brick and other clay products. The officers of the company are: President, James M. Harris; vice-president, Robert M. Gourlay; secretary, William E. Wester; treasurer, Robert B. Lewis.

At the annual meeting of the American Sewer Pipe Co., held in Jersey City, N. J., Alvah Trowbridge was elected director to succeed Charles Baird, resigned, with the other directors re-elected. The capital of the company is $9,000,000, of which $7,500,000 is stock and $1,500,000 is bonds. The company owns sewer pipe and fire brick plants in Pennsylvania, Ohio and Indiana, and controls about 90 per cent. of the output of cewer pipe in the United States.

WATER.

The Utility Water Supply company, Port Huron, Mich., has been incorporated to manufacture pumps and other articles for conveying water. The incorporators are Justus R. Whiting, E. F. Percival and George G. Moore.

MISCELLANEOUS.

The Marietta Stone company, Marietta, O., has been incorporated.

The Brownell Improvement company, Chicago, Ill., has leased the entire plant of the Momence Stone company, at Momence, Ill. G. E. Beale has been retained as superintendent.

The Dean & Hoffman company, Niagara Falls, N. Y., has been incorporated by Fred E. Dean, Albert J. Hoffman, Nellie E. Dean and Helen Hoffman. The company will engage in contracting, furnishing stone, etc.

The National Steel company has contracted with William B. Scaife & Sons, Pittsburg, Pa., for structural steel work for their Ohio works, consisting largely of floor beams, channels and columns.

The S. Howes company of Silver Creek, N. Y., invites bids for the supply of a steam power plant of 100 I. H. P., Corliss type engine and Cahall type upright water tube boiler preferred; induced or forced draft. Bids should be addressed to the company's engineer, M. L. Barbeau.

The Ft. Scott Flagstone and Paving company which operates the quarries on the W. I. Killion farm near Ft. Scott, Kas., will be reorganized at once. Elmer Coe, who is secretary and general manager of the company, has interested five capitalists of Kansas City in the company and officers will be elected as soon as the charter is received from the secretary of state. The quarries will be developed on a much larger scale and the business enlarged in all particulars.

The Union Paving company, Portland, Me., has been incorporated with a capital stock of $250,000. Birney A. Robinson and William W. Carter of Worcester, Mass., are president and treasurer respectively.

The Columbia Bridge company of Pittsburg, Pa., is erecting a new plant at East Carnegie. The present plant, which is located at Edenburg, near New Castle, is becoming inadequate for the increasing business.

The New York Bridge company has been incorporated to build bridges and other structures, by Hector M. Hitchings, Melvin J. Palliser and Irving V. Dooland. The principal office is at 152 Elm-st., Arlington, N. J.

The National Building Supply company, Baltimore, Md., will build a new two-story brick warehouse, 16 by 66 ft., on the site of 243 Smith's wharf.

The Durango & Zacatecas Construction company of Chicago, Ill., has been incorported under Delaware laws to construct railroads, bridges and buildings.

The Electrical Inspection Maintenance company, Pierre, S. D., has been incorported by J. H. Tomlinson, J. J. Post, Henry E. Leavitt, P. J. Knight, L. Taylor and L. C. Smith.

The New York Continental Jewell Filtration company, New York City, has been awarded the contract for installing a 32,000,000-gal. mechanical filtration plant at Little Falls, N. J., for the East Jersey Water company.

The entire power transmitting machinery, consisting of pulleys, couplings, hangers, collars and including a mile of shafting from three to nine inches in diameter for the distribution of 2,000 h. p. throughout the immense new plant of the Singer Manufacturing company, South Bend, Ind., now in course of erection, will be furnished by the Dodge Manufacturing company of Mishawaka, Ind.

In Machinery hall at the Pan-American exposition, Buffalo, one of the working exhibits will be operated by a Dodge American system rope transmission. Taking power from a 250 h. p. Murray engine, the rope will operate a 16x16 Roots rotary pump with capacity of 2,500 gals. per min., at a speed of 180 revolutions per minute. Intending visitors should make note and be sure to see this.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

St. Paul, Minn.—The Board of Public Works has adopted a change in the specifications for asphalt paving which will permit competing companies to bid.

Los Angeles, Cal.—The Board of Public Works has recommended the adoption of new asphalt specifications which will open competition to all asphalt companies and contractors.

Albany, N. Y.—State Engineer Bond says that up to Feb. 12, 1901, 35.17 miles of state roads have been completed at a cost of $266,213. There are 18.41 miles under contract at an estimated cost of $162,953, and the various counties have appropriated $470,306 for their share of building 150.14 miles more.

Butte, Mont.—A new law passed by the recent legislature for public improvements, known as the Gensen law, instead of requiring the signature of two-thirds of the

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property-owners in order to make a public improvement requires that the protest must be signed by two-thirds of the property-owners in order to be effective.

CONTEMPLATED WORK.

Lorain, O.—Second-ave. will be paved.

Pontiac, Ill.—Paving is contemplated for a number of streets.

Kenton, O.—About 8,000 sq. yds. of street paving is contemplated.

Waco, Tex.—About $30,000 of paving is contemplated. J. W. Riggins, mayor.

Oskaloosa, Ia.—Paving is contemplated for S. Third-st. Mayor Wray.

Columbus Grove, O.—About 3,000 sq. yds. of paving is proposed this summer.

Manhattan, Kas.—Brick paving is proposed for Houston-st., west from Third-st.

Baltimore, Md.— The county commissioners have decided to macadamize Sutton-ave.

Dunkirk, N. Y.—Petitions are being circulated to pave Elk and Deer-sts.

Columbus, Ga.—The property-owners on Hamilton-ave. have petitioned for paving.

Tilton, N. H.—The citizens voted in favor of macadamizing Main-st. to the Franklin line.

Evanston, Ill.—An ordinance has been passed providing for paving Harrison-st.

Bristol, Tenn.—About 3,500 sq. yds. of brick paving is proposed. W. L. Reynolds, engr.

Detroit, Mich.—The business men on Gratiot-ave. are in favor of resurfacing the avenue.

Washington, Ia.—The business men are considering the question of paving the public square.

Shreveport, La.—This city has voted to issue $80,000 bonds for paving and street improvements.

Seattle, Wash.—A petition is being circulated to pave ten and one-half blocks of Highland drive with asphalt.

Canton, O.—Bids will be asked early in April for paving a number of streets. P. H. Weber, cy. engr.

York, Pa.—Ordinances have been passed for macadamizing Park and King-sts. and Boundary and Linden-aves.

Port Lavaca, Tex.—The question of issuing $15,000 bonds for roads and bridges will be voted April 30.

Davenport, Ia.—A resolution has been passed to pave Rockingham road and Third, Fourteenth and Fifteenth-sts.

Paterson, N. J.—About 33,751 sq. yds. of asphalt and 330 sq. yds. of brick paving is contemplated this year.

Anderson, Ind.—Bids will probably be received about April 15 for paving 1½ mis. of streets with brick.

Camden, N. J.—This city has ordered the Camden & Suburban railway company to pave about 25,000 sq. yds. of Third-st. with asphalt.

Lead, S. D.—The question of street paving is urged and it is probable that experiments will be made with slag paving.

Champaign, Ill.—The property-owners on N. Clark-st., from Nell to New, are agitating the question of paving.

Earlham, Ia.—A petition for macadamizing Chestnut-st., from Main to Ohio-aves., has been submitted to council.

Decatur, Ill.—Favorable action has been taken by the city council committee for paving Cerro Gordo-st. with asphalt.

Everett, Wash.—The city council has ordered 2½ mis. of street paving, and has asked for specifications for 5 mis. of grading.

Oshkosh, Wis.—The question of paving Algoma-st. with asphalt is being considered, according to local press reports of March 22.

Los Angeles, Cal.—A resolution was adopted March 11 for repairing Main-st., from First to Marchessault, with asphalt.

Dunmore, Pa.—Victor Burschel, burgess, recommends macadam paving for Blakely-st., from Drinker-st. to the Scranton city line.

Portland, O.—Brick paving is proposed for Fourth-st. to replace the wooden block pavement, according to local press reports.

Waterbury, Conn.—The property-owners on Phoenix-ave., from E. Main-st. to Abbott-ave., are unanimously in favor of brick paving.

Cleveland, O.—The property-owners in Euclid Heights have donated land for a boulevard to be built from the Heights to Euclid-ave.

Camden, N. J.—An ordinance has been passed to pave Western-st., between Broadway and Ferry-ave., with Belgian block. H. C. Kramer, clk. cy.

Cedar Rapids, Ia.—The need of paving several cross streets with asphalt is pointed out in the annual report of Geo. H. Meredith, cy. eng.

Bowling Green, O.—Plans are being prepared for 66,033 sq. yds. of brick and asphalt paving, according to press reports. Alex. Williamson, clk.

Pittsfield, Mass.—A committee has been appointed to investigate the question of macadamizing North and Wests-sts. H. A. Fobes, engr. B. P. W.

Philadelphia, Pa.—The council's highway committee has apportioned the $750,000 appropriated for repairing rubble or cobblestone paved streets with asphalt.

Troy, N. Y.—Asphalt block paving is proposed for a portion of Jacob-st. Brick paving is favored for Pawling and Oakland-aves. Cy. Engr. Cary.

Topeka, Kas.—The adoption of resolutions was recommended March 16 for brick paving in portions of Seventh, Ninth, Tyler, Buchanan and other streets.

Cincinnati, O.—A petition for paving parts of Taylor and Columbia-aves. and Hoge-st., with asphalt block, was referred to the city engineer March 14.

Sioux City, Ia.—Preliminary action has been taken for brick paving in portions of Jackson, Jones, Jennings, Court, Virginia, Iowa and Third-sts. this summer.

Denver, Col.—Joel W. Schackelford, president of the board of public works, favors disintegrated granite macadam for the residence streets of this city.

Spartanburg, S. C.—(Special)—T. H. Knox, engr., says that bids will be received about May 1 for 15,000 sq. yds. of brick paving and 12,000 sq. yds. of block paving.

Akron, O.—A petition has been approved by the city commissioners for improving Wheeler Lane alley. Taylor-st., from Main-st. to the canal, has been ordered paved.

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Utica, N. Y.—The petitions for paving Avery, State and Roberts-sts. have been favorably reported and council will determine, April 5, the kind of material to be laid.

Swissvale, Pa.—The borough council passed seventeen improvement ordinances March 19 providing grading and paving for a large number of streets. A hearing will be given April 4.

La Crosse, Wis.—(Special.)—Wendell A. Anderson, mayor, says that 7,300 sq. yds. of brick paving on 6 in. concrete and 40,000 sq. yds .of macadam paving is contemplated.

Petaluma, Cal.—(Special.)—N. S. Frost, cy. engr., says that resolutions of intention to grade, curb and macadamize portions of Walnut, Union, A and Second-sts. have been passed.

Fort Wayne, Ind.—(Special.)—F. M. Randall, cy. engr., says 18,500 sq. yds. of asphalt paving on concrete foundation and 17,900 sq. yds. of brick paving on concrete foundation are contemplated.

Mason City, Ia.—Petitions are being circulated for paving Washington-ave. The residents on the street are in favor of asphalt paving, but it is probable that sandstone macadam will be selected.

Michigan City, Ind.—(Special.)—H. M. Miles, cy. engr., says that bids will be received the latter part of April for 22,500 yds. of brick paving on concrete and 27,500 sq. yds. on crushed stone.

La Crosse, Wis.—The city engineer has been instructed to prepare plans and ask for bids for brick paving on Third, Pine and Badger-sts. and macadam paving on West-ave., Market and Slate-sts. Cy. Engr. Powell.

Norwich, N. Y.—Plans, specifications and estimates for paving a portion of Broad-st. with brick and a portion of Broad, N. Broad and Silver-sts. with macadam have been submitted to the village trustees.

Council Bluffs, Ia.—(Special.)—S. L. Etnyre, cy. engr., says the ordinance for 71,000 sq. yds. of two-course brick paving will come up for final hearing April 8, after which bids will be received.

Fairfield, Ia.—A resolution is pending in the council providing for two-course brick paving with curbing on Burlington, Maine, Broadway and Court-sts.. Jos. Ricksher, mayor; J. F. Deradurff, cy. clk.

Cohoes, N. Y.—A hearing will be given April 4 in the proposed paving of Ontario, Broadway, Lancaster, St. John, Newark, Schuyler, Grant, Newcomb, George, Seneca and Main-sts. and Johnston and Younglove-aves.

Ogden, Utah.—The question of paving Washington-ave., between Twenty-third and Twenty-sixth-sts., is being considered. The property-owners are reported as being in favor of macadam. M. S. Browning, mayor.

Toronto, Canada—The city engineer has recommended the following: Asphalt paving—Wellington, King, Queen and Balmuto-sts., Burk, Bathurst, Manning and George-aves. Cement Walks—Terauley, Beverly, Herne and Yorke-sts.

St. Joseph, Mo.—The property-owners on N. Third-st., between Franklin and Albemarle, have decided that the street must be paved, but they are divided on the material to be used. Asphalt, brick, macadam and granite blocks are advocated.

Owosso, Mich.—The board of public works is reported as being evenly divided on the question of paving with asphalt or brick this summer. The question of issuing $37,000 bonds for paving W. Main-st. will be voted on this spring.

Grand Rapids, Mich.—Estimates have been submitted for macadamizing Godfrey-ave. as follows: Macadamizing with vertical stone curb and brick paved gutters, $15,903.50; brick with gravel foundation, $13,903.50; brick and concrete foundation, $24,142.40.

Columbia City, Ind.—(Special)—A. N. Miller cy. engr. says that resolutions have been passed and the contract will be let about May 1 for 2½ or 3 miles of brick or macadam paving on stone foundation with sand cushion on three of the principal streets.

Baltimore, Md.—Ordinances were passed March 18 for paving Chesapeake-st., between Fairmount-ave. and Fayette-st. An ordinance was introduced for repairing Fort-ave., from the B. & O. R. R. tracks on Lawrence-st. to Ft. McHenry, with Belgian blocks.

Minneapolis, Minn.—The principal paving to be done during the present year will be on Washington-ave., north, between Thirty-second and Forty-second-aves., which will be paved with macadam with gravel top dressing. Considerable work will also be done on the east side, University-ave. and Seventh-st., southeast.

Richmond, Va.—Col. John Murphy is urging this city to pave Eighth-st., between his present hotel and the annex which is to be built on the western side of Eighth-st., with asphalt on vitrified brick. As he is willing to bear a portion of the expense it is possible that the street committee will consider his proposition.

Wapakoneta, O.—(Special)—Samuel Craig, surveyor, says the council passed a resolution March 26, declaring it necessary to improve Blackhoof-st., from Auglaize-st. to the T. & O. C. R. R., a distance of 2,100-ft., by grading, draining, curbing and paving with brick. The engineer was ordered to prepare plans and specifications.

Newark, N. J.—City Counsel Price has rendered an opinion to the board of works stating that the board can advertise for bids for more than one kind of paving. Motions of intention were published March 7 for paving ten streets with asphalt and seven streets with granite.

Boston, Mass.—The street department has decided to pave the following streets this year: Asphalt—Gold-st., $4,770; Bowen-st., $7,700; Tudor-st., $3,700; Silver-st., $7,700; Athens-st., $3,900; streets bounding Copley-square, $42,100; Massachusetts-ave., N. S. Beacon-st., across Huntington-ave., $74,000; Boylston-st., $34,000; Arlington-st., $31,000; Beacon-st., $42,000. Granite Blocks—Congress-st., $42,000; High-st., $44,700, Union-st., $181,400; Dock, Faneuil Hall and Adams-squares. $251,000; Franklin-st., $18,700; Milk-st., $16,400; Indian-st., $10,100; Pearl-st., $16,700; E. First-st., $23,300.

Indianapolis, Ind.—Resolutions were adopted March 27 for the paving as follows: Asphalt: State-ave., Washington to Michigan; Sutherland-ave., Central to College-ave.; Bellefontaine-st., Fifteenth to Twenty-first-st. Gravel, with Cement Walks and Curbing—Warman-ave., from Tenth to Clark. Wood

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Blocks—Highland-ave., from Washington-st. to Marlowe-ave.; Ohio-st., from Noble-st. to Arsenal-ave., and Illinois-st., from Fall creek to Thirty-fourth-st. The list of improvements for which plans have been prepared includes about eighty streets, consisting of asphalt, brick, gravel and wooden block paving and cement walks.

Ashland, Wis.—(Special.)—Finley Wharton, cy. clerk, says that recommendations were submitted by the board of public works March 12 to the common council for the following: Slagging Second-st., W. from the Omaha railroad track to Fifteenth-ave., W., three blocks, in place of the present cedar block pavement; curbing and slagging Second-ave. to Fourth-ave. W., and Vaughn-ave., two blocks each, from Front to Third-sts. No action was taken on the recommendation. The board also called the attention of the council to the fact that Second-st., from Stuntz-ave. to Fifteenth-ave. W., 22 blocks, will require repaving within a year, and recommends brick as the most sanitary and economical paving material.

CONTRACTS TO BE LET.

Waukesha, Wis.—Bids are asked until April 13 for paving certain streets, according to press reports.

Omaha, Neb.—Bids are asked until April 5 for grading Twenty-second-st., from Fowler to Meredith-ave. B. P. W.

Cincinnati, O.—Sealed bids are asked until April 6 for improving the Montauk road. E. L. Lewis, co. engr.

Wilkesbarre, Pa.—Bids are asked until April 9 for brick paving on St. Clements-st. D. J. Jones, chmn. Joint St. com.

Waukesha, Wis.—Sealed bids are asked until April 13 for macadamizing Maple and Dunbar-aves. J. P. Day, cy. engr.

Astoria, Ore.—Bids are asked until April 8 for constructing 42 miles of road or any part of it in Clatsop county. H. J. Wherity, co. clk.

Columbus, Ind.—Sealed bids are asked until April 8 for constructing a macadam road from Greenland to Haddenfield. Dr. J. B. Davis, dir.; J. J. Albertson, co. eng.

Van Wert, O.—Sealed bids are asked until April 16 for furnishing, crushing and delivering 54,000 yds. of crushed stone or gravel in Pleasant road district. G. L. McKibben, cons. engr.

Spokane, Wash.—Sealed bids are asked until April 9 for paving Washington-st. with asphalt on cement concrete foundation, with granite curbing. R. E. Clarke, secy. B. P. W.

Cincinnati, O—Sealed bids are asked until April 15 for the construction and repair of all brick sidewalks in the eastern and western sidewalk districts. Robert Allison, Prest. B. P. S.

Chicago, Ill.—Sealed bids are asked until April 10 for the stone and earth now piled along the channel of the main drainage canal between Roby-st. and Lockport. Alex. J. Jones, Pres. bd. trustees.

Winnipeg, Maine—Sealed bids will be received until April 18 for the supply and delivery of 200 tons of asphalt for street paving. Check or cash deposit of $400 required. C. J. Brown, Cy. Clk.

Findlay, O.—Sealed bids are asked until April 20 for paving Cory-st., from Fair to Frazer, with vitrified block, with curbing, gutters, crosswalks, drainage, etc. Frank C. Ray, clk. bd. impvts.

Bellefontaine, O.—Sealed bids are asked until April 3 for macadamizing, curbing and guttering six streets, consisting of about 93,832 sq. yds. of macadam and 24,000 ft. of curbing and guttering. M. J. Nichols, Cy. Clk.

CONTRACTS AWARDED.

Greenville, O.—Webster & Farr secured the contract March 18 for paving Washington-ave. with brick.

Harrison, N. J.—The Barber Asphalt Paving company was awarded the contract March 5 for paving Lodi-st, with asphalt for $2,578.50.

Chillicothe, O.—Plaff, Ringwald & Smith submitted the lowest bid March 8 for brick paving and curbing at $21,428.56.

Bloomington, Ill.—John Cherry was awarded contracts March 14 as follows: Park-st., $12,851.28; Evans-st., $1,029.16; Beecher-st., $2,196.27.

St. Paul, Minn.—Fielding & Shepley secured the contract for boulevarding and curbing Laurel-ave., from Victoria to Chatsworth-st., for $2,110.

Des Moines, Ia.—The Likes Improvement company has been awarded a contract for 3,362 sq. yds. of brick paving at $1.62 a sq. yd. on 6-in. broken stone concrete foundation.

Kansas City, Mo.—Paving contracts have been awarded to Fred Fingel, the Gilsonite Paving company, the Trestrail Paving company, A. R. Mense and the Barber Asphalt Paving company.

Elizabeth, N. J.—Paving contracts have been awarded as follows: N. Broad-st., asphalt, Barber Asphalt Paving company, $59,022; Spring-st., Telford, Michael Fitzgerald, $5,342.

Council Bluffs, Ia.—(Special.)—S. L. Entyre, cy. engr., says contracts for 76,000 sq. yds. of brick paving was awarded to E. A. Nickham and 17,000 sq. yds. to B. P. Nickham.

Easton, Pa.—The Delaware River Quarry and Construction company has been awarded the contract for improving the Delaware river road from the eastern to the Bucks county line for $37,616.

Davenport, Ia.—The Davenport Construction company submitted the lowest bid March 19 for brick paving as follows: Fifteenth and Sixteenth-sts., $1.28 a sq. yd.; Third-st., $1.27; Rock road, $1.26.

Freeport, Ill.—The contract for paving the roadway along the Central & Northwestern freight house, from Stephenson to Washington-st., with vitrified brick in cement was awarded to G. J. W. Stewart for $7,000.

Seattle, Wash.—The San Francisco Paving company was awarded the contract March 12 for $46,000 worth of macadam paving in the first forty acres of the tract of land owned by the Moore Investment company.

Ripon, Wis.—The contract for brick paving was awarded to T. J. McGrath of Green Bay, Wis., as follows: Metropolitan block, $1.59 a sq. yd.; excavating, 23 cents a cu. yd.; stone curbing, 37 cents a foot.

Elgin, Ill.—The contract for paving Forest-ave. with brick was awarded to Smith, Moss & Brown of Chicago for $5,074. The same company secured the contract March

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18 for paving Brook-st. with brick for $8,350.

Lawrence, Kas.—The contract for paving Tennessee and Warren-sts. with brick was awarded March 4 to Chapin & Greener at $1.37½ a sq. yd. Ritchie & Ramsey secured the contract for paving Henry-st. with brick, March 18, at $1.34½ a sq. yd.

St. Paul, Minn.—The Barber Asphalt Paving company submitted a bid March 5 for repairing asphalt pavements on which contract the guarantee term has expired, as follows: Sheet asphalt, without cement, $2 a sq. yd.; concrete foundation, $1 a sq. yd.

Racine, Wis.—Macadam paving contracts were awarded March 16 as follows: Milwaukee-ave., P. B. Johnson, with sandstone curbing and brick gutters; W. Main-st. and High-st., R. R. Birdsall; Mead-st., James Cape & Son; Washington-ave., Nelson & Harding.

Petaluma, Cal.—(Special.)—W. S. Frost, cy. engr., says bids have been received for 1,440 sq. ft. of cement walks at 10 cents; 4,000 sq. ft. at 11¾ cents; 3,700 cu. yds. of grading at 21 cents, and 7,830 sq. ft. of grading and macadamizing at $3.44 complete.

Annapolis, Md.—Joseph Jewell was awarded the contract March 18 for paving King, George, Holland, Craig, East, Randall and South-sts. with rubble stone for $5,754.77; to George Jewell for paving Northwest, Carroll, North and Franklin-sts. with rubble stone, for $9,326.77.

Joliet, Ill.—The contract for paving Cass-st., bids for which were opened Feb. 25, was awarded to C. J. Smith of this city as follows: Three thousand six hundred square yards of Galesburg brick paving, $1.37; 1,400 lin. ft. curbing, 47 cents; 60 cu. yds. extra concrete, $2.25; total, $5,725.

Toledo, O.—The lowest bidders for paving Tenth-st., from Washington to Adams, March 21, were as follows: C. M. McKinney, vitrified block with Indiana curbing, $16,932.20; Barber Asphalt Paving company, Trinidad pitch lake, $12,123.40; Cleveland Trinidad Paving company, Trinidad asphalt, $13,719.69; C. H. Burchenal, asphalt block, $13,812.05.

Baltimore, Md.—The contract for paving Baltimore-st., from Grave-st. to the eastern limits, with asphalt, was awarded March 14 to the Southern Asphalt Paving company at $2.17 a sq. yd., or $19,264.67. The Filbert Paving and Construction company was awarded the contract for paving Maryland-ave. with Belgian block at $1.99 a sq. yd. or $211,693.61.

Chicago, Ill.—Bids were received March 20 for $570,000 worth of street paving. The R. F. Conway company was lowest bidder on the following: Forquer-st., brick, $2.13 a sq. yd.; Grand-ave., brick, $2.14; Haymarket-st., granite block, $3.59; Fortieth-ave. system, macadam, 88 cents for paving and 62 cents for curbing. The other low bids submitted were W. Adams-st., asphalt, Standard Paving company, $2.24; Albany-ave., asphalt, Western Paving and Supply company, $2.10; Forty-seventh-st., macadam, T. Burke, $1.52; Normal-ave., macadam, Smith, Moss & Brown, 70 cents.

St. Paul, Minn.—(Special)—Bids were opened March 21 for asphalt paving as follows: Rice-st., from College-ave. to University-ave., R. F. Conway Co., Chicago, city's portion, 10,516 sq. yds., $22,285; railroad's portion, 2,567 sq. yds., $5,647; total $27,932; Barber Asphalt Paving company, $27,087.33 and $6,494.51 respectively; total $33,581.84. Rice-st., from University-ave. to Como-ave., R. F. Conway Co., city's portion, 2,958 sq. yds., $6,589; railroad's portion, 2,537 sq. yds., $5,581; total $12,270; Barber Asphalt Paving company, $7,695.60 and $6,418.61 respectively; total $14,114.21.

Atlanta, Ga.—Bids were received March 18 for paving Capitol-ave. with asphalt as follows: Warren Bros., Utica, N. Y., California asphalt, 2 inches; surface, 1-inch binder, using stone for concrete, $2.63 a sq. yd.; using old stone for concrete, $2.53; Southern Paving and Construction company, Chattanooga, Tenn., using stone for concrete, $2.53; using old macadam for concrete, $2.34; 1½ inches asphalt and 1½ inches cushion, $2.75 a sq. yd.; 2 inches asphalt and 1½ inches cushion, $2.75; Venable Bros., Atlanta, using new stone, $2,529; using old macadam, 1½-inch Trinidad and 1½-inch cushion, $2.49.

Buffalo, N. Y.—Bids were received March 6 for paving or repaving eleven streets. The Warner-Quinlan Asphalt company bid on nine of these streets and was the lowest bidder on five of them. Bids were opened March 14 for paving Grace and Tousey-sts., and Pomona-place. The Warner-Quinlan company was the lowest bidder on Grace-st., the German Rock Paving company on Tousey-st., and the American Contracting company on Pomona-place. The Warner-Quinlan company submitted the lowest bid March 20 and secured contracts for the following streets: Prenatt-st., $2.249 a sq. yd.; Burgard-place. $2.695; repairing Ohio-st., $1,484.

Rome, N. Y.—Bids were opened March 12 for paving three streets, as follows: N. George-st., Barber Asphalt Paving company, asphalt, $31,676; Warren-Scharf Asphalt Paving company, Utica, N. Y., asphalt, $32,771; Warner-Quinlan Asphalt Paving company, Syracuse, N. Y., asphalt, $32,000; Interstate Paving company, Rome, N. Y., asphalt, $35,972; N. J. Cramond, Rome, brick, $40,488 to $44,438; Louis W. Edy, Rome, brick, $41,390 to $44,850. W. Dominick-st., N. J. Cramond, brick, $9,153 to $10,126. N. Washington-st., Barber Asphalt Paving company, asphalt, $24,587; Warren-Scharf Paving company, $25,179; Interstate Paving company, $28,127; Warner-Quinlan Asphalt company, $24,014; N. J. Cramond, brick, $30,541 to $33,781.

Minneapolis, Minn.—Bids were opened March 8 for furnishing materials as follows: For granite paving blocks, 40,000 sq. yds.: Robert Graham bid $1.70 per sq. yd. rock faced or ⅜-in. top and $2.03 per sq. yd. ½-in. face. Arnold Granite company bid $1.44½ and $1.69½ per sq. yd. For asphalt paving blocks, 40,000 sq. yds.: Lake Erie Asphalt Block company bid $1.92 per sq. yd. for blocks 3 in. thick, 12 in. long and 4 to 5½ in. wide; $2.11 for blocks 4 in. thick, 12 in. long and 4 to 5½ in. wide. For asphalt furnished and delivered, 40,000 sq. yds.: Barber Asphalt Paving company bid $1.98 per sq. yd., or furnished and laid, $2.05 per sq. yd. For vitrified brick, 40,000 sq. yds.: Flint Brick company bid 98 cts. per sq. yd.; specials, 25 cts. per sq. yd. additional. Purington Paving Brick company., 98 cts. per sq. yd.; specials, 25 cts. per sq. yd. additional. Gales-

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burg Paving Brick company, 91 cts. per sq. yd.; specials, $1.20 per sq. yd. Wooster Shale Brick & Clay company, $1.13 per sq. yd.; specials, $1.17 per sq. yd.

Garrett, Ind.—(Special.)—J. J. Van Auken, C. E., says that the contract for brick street paving in this city was awarded March 5 to Kelley Bros. of Portsmouth, O., as follows: 11,000 cu. yds. exc. 22 cts. per cu. yd. in cut; Metropolitan block paving, including gravel stone foundation and cement filler, $1.16 a sq. yd; curb, 4x18 laid, 33 cts. a lin. ft. Bedford stone curb, 4x20, 35 cts.; 5x22, 45 cts.; 6x24, 54 cts.; headers, 3x15, 16 cts.; street inlets, $10 each; manholes, $30 each; cement walk and curb, 13 cts. a sq. ft.; cast iron pipe, 3 cts. per lb.; cast iron crossings, 3 cts. per lb.; 8 in. sewer pipe, 90 cts.; 8 in. sewer traps, $4 each; 4 in. drain tile, 5 cts. per ft.; sand filler, 5 cts. a sq. yd.; total, $42,438.25. The other bidders were Petit & Abele of Zanesville, O.; Hill, Kellner & Groscop, Garrett, Ind.; Kerlin Bros. & Co. of Toledo, O.; E. M. Seamans, Grand Rapids, Mich.; Wayne Paving company, Detroit, Mich.; F. M. Kemp & Sons, Middletown, O.; Thomas Burke, Chicago, Ill.; C. M. Kirkpatrick, Greenfield, Ind.; Frank Brumbaugh, Elkhart, Ind.; Robert Hoban & Roach, South Bend, Ind.; E. E. Moellering & Co., Ft. Wayne, Ind.; Derheimer & Hill, Ft. Wayne, Ind.; W. W. Hatch & Son, Goshen, Ind.; Moore & Henley, Bloomington, Ind.; F. B. & J. J. VanAuken, engrs., Auburn.

SEWERS.

Baltimore, Md.—Walter Stebbins has been appointed to serve on the sewerage commission to take the place of Mendes Cohen, who declined to serve.

Galveston, Tex.—Judge Stewart rendered a decision March 7 in the mandamus case of the Galveston Sewer company vs. Mayor Walter O. Jones. The decision was in favor of the plaintiff. The action was brought by the sewer company to compel Mayor Jones to sign a warrant for $93,600, which amount was appropriated by the city council for the purchase of the plant of the Galveston Sewer company.

CONTEMPLATED WORK.

Green Bay, Wis.—A large number of sewers will be built.

Watertown, Mass.—This town has appropropriated money for sewer construction.

Massillon, O.—The construction of three sewers is recommended.

Belmond, Ia.—A petition is being circulated for a sewer on Main-st.

Gardner, Mass.—The sum of $21,000 has been appropriated for sewers.

Atlanta, Ga.—The extension of the Wall-st. trunk sewer is contemplated.

Janesville, Wis.—The question of building a sewerage system will be voted on.

Menasha, Wis.—The expenditure of $14,000 for sewer construction is proposed.

East Hampton, Mass.—The sum of $6,000 has been appropriated for new sewers.

East Syracuse, N. Y.—The question of a sewerage system is still under discussion.

East Cleveland, O.—The council has decided to double the present sewage disposal plant.

Bennington, Vt.—This village voted March 19 to survey for a surface system of sewers.

Abilene, Kas.—The residents west of the creek are agitating the question of building a sewer.

Sherman, Tex.—The question of issuing $86,000 bonds for building a sewerage system will be voted on April 2.

Sandy Hill, N. Y.—This town has voted to issue $95,000 bonds for building a sewerage system. J. P. Monty, engr.

Sault Ste. Marie, Mich.—Plans for a complete sewerage system are being made by Louis Chipman, C. E., of Toronto, Ontario.

Florence, Tenn.—The council has decided to issue $5,000 bonds for building a new stone sewer in the western part of town.

Indianapolis, Ind.—Petitions were filed, March 27, for a main sewer in Northwestern-ave. and local sewers in certain streets.

La Crosse, Wis.—(Special.)—Wendell A. Anderson, mayor, says an extension of 2,000 ft. of 12-in. sewer is contemplated.

Madison, N. J.—L. L. Tribus, C E., New York City, has been engaged to advise the borough regarding a sewerage system and disposal plant.

Springfield, Mo.—An ordinance has been passed establishing sewer district No. 16 of Section 2 of the main sewers. Ralph Walker, mayor.

Chicago, Ill.—Definite plans were decided upon by L. E. McGann, com'r of pub. wks., March 14, for the construction of sections G and H of the intercepting sewers.

St. Paul, Minn.—(Special.)—O. Claussen, cy. engr., stated, March 12, that bids for a sewerage system costing approximately $40,000 would be advertised within a week.

Dayton, O.—A resolution was adopted, March 8, instructing City Engineer Turner to prepare plans and specifications for sewers in Salem, North, Neal and Bellevue-aves. and Summers-st.

Ashland, Wis.—(Special.)—Finley Wharton, cy. clk., says that the construction of a sanitary sewer in the alley between Eleventh and Twelfth-aves., from Fourth to Eighth-sts., has been recommended.

Newark, N. J.—Representatives of Newark, Vailsburgh, Irvington, South Orange, West Orange, Millbury and Summit met March 15 and signed a contract to carry out the joint trunk sewer project.

Celina, O.—(Special.)—The city council has passed a resolution for an election to be held April 1 for the purpose of issuing $50,000 bonds for the purpose of building a sewerage system. Mayor Landfair.

Baltimore, Md.—Mayor Hayes, City Engineer Fendall, City Water Engineer Ivick, Electrical Engineer Phelps and Kenneth Allen, consulting engineer, decided, March 4, that a $12,000,000 sewerage loan was necessary.

Michigan City, Ind.—(Special.)—H. M. Niles, cy. engr., says that bids will be received in April for 1,000 ft. of 30 and 24-in. brick sewer; 1,500 ft. of 18 and 15-in. pipe, 2,000 ft. of 12-in. pipe and 1,900 ft. of 10-in. pipe sewers.

Winchester, Ind.—(Special.)—C. C. Yunker, cy. engr., says that he is making plans and specifications for a separate sewerage system consisting of about 3 mls. of trunk or

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main sewers and ten miles of lateral sewers.

The construction of sewerage systems is contemplated at the following places: Savannah, Ill.; New Decatur, Ala.; Burlington, N. J.; Oswego Falls, N. Y.; Hartford City, Ind.; Venice, Ill.; Oneonta, N. Y.; Merced, Cal.; Clarksburg, W. Va.; Connellsville, Pa.

CONTRACTS TO BE LET.

Ocean City, Md.—Bids are being asked until April 3 for a sewerage system. John L. Streeter, cy. clk.

Decatur, Ind.—Bids are asked until April 2, for building a sewer in Elm-st. H. B. Knok, c. y. engr.

Circleville, O.—Sealed bids are asked until April 8, for building sewers. Fred R. Nicholas, cy. clk.

Cincinnati, O.—Sealed bids are asked until April 3, for building a sewer in Bloody Run. Robert Allison, pres't B. P. S.

Omaha, Neb.—Sealed bids are asked until April 5 for sewers in Burdette, Ohio, Castelar and Twenty-seventh-sts. B. P. W.

Newark, N. J.—Bids are asked until April 4, for 4,765 ft. of 105 to 58 in. brick trunk sewer. Bd. lt. and water comm's.

Merchantsville, N. J.—Proposals are desired for building a complete sewerage plant on the franchise plan. William A. Holham, chm. borough. W. B. Stewart, clk.

Havana, Cuba.—Sealed bids are asked until May 29, (postponed from April 3rd) for a sewerage system. W. J. Borden, Corps of engrs. U. S. A. Ch. engr. city of Havana. Alexandre Rodriguez, mayor.

CONTRACTS AWARDED.

Olathe, Kas.—The contract for constructing a main sewer has been awarded to M. L. Kinlen of Kansas City, Mo.

Des Moines, Ia.—The Likes Improvement company secured the contract for an overflow sewer at First and Ivant-sts., for $1,195.

Xenia, O.—The contract for building a large sewerage system was awarded to A. F. Shover, Indianapolis, for $20,155.40.

Webb City, Mo.—The contract for building new sewers was awarded March 12 to the Meyer Construction company of St. Louis, for $9,259.31.

Bloomington, Ill.—J. H. Colby of St. Louis was awarded the contract Nov. 15 for extending the west slough sewer 1616-ft., for $9,000.

Kansas City, Mo.—Mr. Michael Walsh secured the contract for a sewer from Eighteenth and Tracey-sts. to Twenty-seventh and Brooklyn-sts., for $71,045.

Denver, Colo.—The contract for work in sub-district 19 of the Capitol Hill storm sewer dist. No. 1 was awarded to the John M. O'Rourke Construction company, for $11,376.

Bridgeport, Conn.—The contract for 1,250-ft. of new sewer, including manholes, basins, slants, etc., has been awarded to the Pierce Manufacturing company of this city, for $7,684.50.

Joplin, Mo.—(Special)—S. J. McKee, cy. engr., says the contract for building 400-ft. of 8-in. pipe sewer was awarded to the Jopline Construction company, March 5, at $1.70 a lin. ft.

Glencoe, Ill.—The contract for building 13,097-ft. of sewers was awarded March 16 to Charles M. Porter of Chicago for $19,756. The contract for the purification plant has not yet been awarded.

Neenah, Wis.—(Special)—L. C. Hjorth, cy. engr., says the contract for constructing sewers in the First and Second districts was awarded March 22 to J. H. Green & Son, of Appleton, Wis., for $14,013.05. The work consists of the following: 1,100-ft., 30-inch; 1,082-ft., 24-inch; 844-ft., 20-inch; 708-ft., 18-inch; 6,749-ft., 15-inch; 1,511-ft., 12-inch; 1,450-ft., 9-inch; all to be of standard vitrified pipe. Also 28 manholes, 42 catchbasins and 8 lampholes, all complete with iron tops; all materials to be furnished by contractor.

WATER-WORKS.

Murfreesboro, Tenn.—This city has in contemplation the purchase of water works.

San Diego, Cal—This city purchased the entire property of the San Diego Water company, March 13, for $500,000.

Independence, Ia.—The city council will investigate the water supply, which, it is claimed, is responsible for the typhoid at the State insane hospital.

Chicago, Ill.—The American Water company has begun suit in the circuit court against the Chicago Union Traction company, alleging injury to the company's water pipes through electrolysis.

Boston, Mass.—The Metropolitan Water and Sewerage Boards have been consolidated and Henry H. Sprague, Henry P. Walcott and Jas. A. Bailey, jr., appointed commissioners of the new board.

Butte, Mont.—Judge Knowles of the United States court authorized March 4 the sale of the property of the Butte City Water company to satisfy a claim of $2,412,814.57 held by the Massachusetts Loan and Trust company.

Mt. Vernon, Ill.—The report of John J. Hainsworth, consulting engineer, of Indianapolis, Ind., in relation to the transfer of the water works and electric light properties from private to public ownership, was adopted March 15 and the plants were formally transferred to the city.

Topeka, Kas.—The city council instructed the city attorney March 14 to draw up the necessary ordinances to enable the city to acquire the water works system through condemnation proceedings. The city proposes to purchase the plant, which is now owned by a private corporation.

Portage, Wis.—The Portage City Water Works company has submitted a proposition to this city to sell and transfer to the city the water plant complete, including the company's franchise, for $42,500. A special election will probably be held in April to allow the citizens to vote on the proposition.

Flushing, (L. I.), N. Y.—Leonard C. C. L. Smith, engineer in charge of the Queens Borough water department, urges the consolidation of the three water systems of Flushing, Whitestone and College Point, the principal reason for the connection of the three systems being that while there is a deficiency in the Flushing and Whitestone systems there is a surplus in the College Point system.

Boston, Mass.—The water in the reservoir controlled by the Metropolitan water board was so low up to the early part of March

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that the board warned the citizens of this city and vicinity to guard against waste. For January and February, 1901, the flow of the Sudbury river was one-quarter the average flow, and but little more than one-half the lowest flow for the same period during the last twenty years.

Keokuk, Ia.—(Special.)—J. Ross Robertson, cy. engr., says that at the regular meeting of the city council March 4 the mayor appointed two appraisers on behalf of the city to act with two to be appointed by the water works company, who, together, would appoint a fifth person, to appraise the Keokuk water works with a view to purchasing the same. The appraisers appointed by the city were Maj. M. Meigs and the Hon. John H. Cole, both of this city.

Rock Island, Ill.—The city health department located March 18 what they believe to be the main cause of the infection of city water with typhoid fever germs, and ordered the immediate shutting off of the supply at all public schools. Large cracks in the masonry of the well at the water works, into which the water supply of the entire city flows as it is pumped in through the intake pipe, were discovered, through which the seepage from the slough has been leaking.

Cincinnati, O.—The commissioners of water works are preparing to begin legal proceedings against the Lane & Bodley company for the recovery of damages because of the failure of the company to carry out its construction of the pumping machinery for the eastern pumping station. damages for the difference between the amount of the Lane & Bodley contract and the amount of the proposal of the Camden Iron works, to which the contract was let in February, amounting to over $300,000. will be claimed.

Laurel, Md.—In a test case brought before the court of appeals to test the legality of the wording of a section of a bill passed by the Maryland legislature Judge Briscoe established the legality of the bill. The bill was entitled "an act to authorize the mayor and city council to issue," etc., omitting the words "of Laurel." The firm will be notified of Judge Briscoe's decision, and should it refuse to accept the bonds it will forfeit its own bond, and the second bidder will be notified.

Ogden, Utah.—The Bear River Irrigation and Ogden Water Works company has been reorganized and incorporated under the laws of Oregon. The Ogden City Water Works company passed into the hands of the newly organized company March 19. The company now proposes to enforce the payment of water rentals, in opposition to a resolution passed by the city council warning consumers against such payment. When the resolution was passed an injunction was threatened to prevent the company from shutting off water of consumers who had failed to pay their rental. If such an injunction is sought now it will be taken to the federal court instead of the district court, as heretofore. In the various litigations over the ownership of the system the federal court has been favorable to the city, while the state courts have favored the city, it is alleged.

CONTEMPLATED WORK.

Telluride, Col.—An increased water supply is needed.

Arcola, Ill—The establishment of a water system is proposed.

Oneida, N. Y.—The question of a water supply will be voted on again.

Louisville, Ky.—A filtration plant at Lakeland asylum has been decided upon.

Atlanta, Ga.—The question of issuing $200,000 bonds was favorably voted on March 20.

New Albany, Ind.—Extensive improvements are contemplated by the New Albany Water Works company.

Wells, Minn.—Another reservoir and new pump for the water works system are needed.

St. Cloud, Minn.—Filtration of the city water supply is contemplated, according to press reports.

Martinsburg, W. Va.—The improvement of the water works plan is proposed. A. F. Lambert, cy. clk.

Pontiac, Mich.—The expenditure of $50,000 for water works extension and improvements will be voted on in April.

Kokomo, Ind.—The city council has authorized its water committee to ask for bids for a municipal water plant.

Jasper, Minn.—An engineer will probably be employed to make plans and specifications for a water works system.

Hopkinton, Ia.—Bids will probably be received the latter part of April for building water works. F. C. Reeve, clk.

Evansville, Ind.—Mechanical filtration is recommended by the water works trustees at a cost of $300,000.

Paoli, Ind.—Experiments are being made by the city council with a view to securing a better water supply.

Austin, Tex.—Bids for an engine to operate the 6,000,000 gal. pump now in use will be received by Supt. Patterson.

Itasca, Tex.—The purchase of a 72,000-gal. compound duplex pump is proposed for the water works. James W. Hackaday.

Kahoka, Mo.—Plans and estimates for a water works system will be made by George C. Morgan of Chicago. J. T. Laughlin, cy. clk.

Ft. Atkinson, Wis.—Plans for a water works system for this city have been prepared by C. F. Loweth, C. E., of St. Paul, Minn.

Tell City, Ind.—(Special.)—H. J. Stuehrk, cy. clk., says that plans for water works are now being prepared by John J. Hainsworth of Indianapolis.

Woodbury, N. J.—The council will readvertise for bids for pumping machinery for the water plant according to press reports.

Chrisman, Ill.—The citizens are in favor of granting a franchise for constructing water works. J. M. Wasson, twp. clk.

Kirkwood, Mo.—The question of granting a franchise to Guy A. Jurden for erecting a water plant will be voted on April 2.

Brockton, Mass.—Charles R. Felton, cy. engr., has been authorized to employ a consulting engineer regarding a water supply.

The question of issuing water works bonds has been favorably voted on at the following places: Dublin, Ga.; Copenhagen, N. Y.; Voorheesville, N. Y.

Philadelphia, Pa.—New bids will probably

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be asked soon for the filter plant for Lower Roxborough. The recent bids were rejected owing to a court decision.

The extension of the water mains is contemplated as follows: Hartford, Conn., 9,500 ft.; Jackson, Mich.; Granite Falls, Minn.; Bloomington, Neb.; Hayfield, Minn.

Glenwood Springs, Col.—The question of issuing $80,000 bonds for municipal ownership of the water works and electric light plant will be voted on this spring.

Ft. Collins, Col.—The city council committee has reported in favor of extending the main supply pipe to a point above this city; estimated cost, $185,000.

Worcester, Mass.—The water committee has voted to ask for $150,000 of which $100,000 is for the completion of the Holden reservoir and $50,000 for pipe laying.

Iroquois, Ont.—The question of issuing $20,000 bonds for the purchase and extension of the present water works system will be voted on April 9. Allen McQuinn, cy. clk.

Grand Rapids, Wis.—The question of issuing bonds for $60,000 for the purchase of the water works system and for extending the system to the East Side will be voted on April 12.

Syracuse, N. Y.—The extension of water mains in the village of Elmwood, recently annexed to the city, is contemplated. John H. Moffett, supt. bureau of sts., Syracuse.

Jamestown, N. Y.—J. F. Witmer, C. E., of Buffalo, who is making plans for a municiual water plant for this city, has decided upon Clifton, near Chautauqua Lake, for a source of water supply.

Lynchburg, Va.—The water committee has voted to expend $1,000 in an investigation of proposed plans for a pure water supply. City Engineer DeMott recommends the employment of an expert engineer.

Franklin, Pa.—(Special.)—The water works system, or a part interest in it, is offered for sale to a party who will greatly improve it. If not sold the works will be improved by sinking an immense well 50 feet in diameter and 35 feet deep. John Haupt.

Philadelphia, Pa.—The introduction of water meters in all premises where the owners desire them is favored by the council's water committee. An ordinance has been recommended which provides for laying water conduits and pipes from Lardner's Point to the Wentz farm reservoir.

The question of issuing bonds for the building of water works will be voted on at the following places: Gastonia, N. C., May 6: Roanoke, Ala., April 10; Elk Point, S. D., Elm Valley, Minn., Cumberland, Ia., Cadott, Wis., April 2; Mackinaw, Ill., Woodbine, Ia., Brookings, S. D., Excelsior, Minn., Sioux Falls, S. D., April; Riceville, Ia.

Phoenix City, Ala.—(Special.)—W. D Wilkins, mayor, has been authorized by the legislature to sell bonds to the amount of $25,000 for the construction of a water works in said town. The mayor and board have engaged Alber & Byrne, consulting engineers of Birmingham, Ala., to prepare the plans and specifications, and superintend the construction of the same.

Kansas City, Mo.—The proposed improvements to the water works are as follows: Installing two 300 horse power boilers at Quindaro pumping station; building line from Twelfth and Bell to Kaw Point; purchase and erection at Quindaro of one, with privilege of two, 10,000,000 triple expansion engines; construction of certain 8, 10 and 12-inch lines in business portion of city; construction of 30-inch high grade pressure lines, Kaw Point to Quindaro, and all necessary work to divide city into low and high service districts. Supt. Longwell.

The construction of water works systems is contemplated at the following cities and towns: Topsham, Me.; Marseilles, Ill.; Park River, N. D.; Essexville, Mich.; River Rouge, Mich.; Lewisburg, Tenn.; Schoharie, N. Y.; Sheridan, Mo.; Carbondale, Pa.; Dexter, Me.; Parish, N. Y.; Ft. Morgan, Col.; Napoleonville, La.; Harpersville, N. Y.; Smithville Flats, N. Y.; Kirkwood, S. C.; Ellisville, Miss.; Murfreesboro, Tenn.; Winchester, Tenn.; Princeton, Ky.; Augusta, Mich.; Vermontville, Mich.; Excelsior, Minn.; Tell City, Ind.; Kimballton, Ia.; Wilton, Wis.; DeGraff, Minn.; Woodstock, Minn.; Lamont, Ia.; Wethersfield, Conn.; Motley, Minn.; Henry, Ill.; Sheffield. Ala.; Gadsden, Ala.; Graettinger, Ia.; Gloster, Minn.

CONTRACTS TO BE LET.

Lewiston, Minn.—Bids will be received April 15 for building a water works system. Chas. Posz, vil. clk.

Ocean City, Md.—Bids will be received until April 3 for building a water works system. John L. Streeper, cy. clk.

Fonda, N. Y.—Sealed bids are asked until April 8 for building a water works system for the Fonda Water Works company, A. H. Burtch, pres.

Everett, Mass.—Bids are asked until April 3 for 1,177 lengths of 6 to 12-in. cast iron pipe; 85, 6x6 to 12x10, tees, etc. M. McNamara, chmn. B. P. W.

Ft. Wayne, Ind.—Sealed bids are asked until April 23 for an air-lift pumping plant to supply this city with water. P. J. McDonald, clk. B. P. W.

Pittsfield, Mass.—Bids are asked until April 2 for furnishing 100 tons of 4 to 10.-in. cast iron water pipe. J. S. Bacon, chmn. of bd.

Indianapolis, Ind.—Bids are asked until April 10 for furnishing and erecting a triple-expansion pumping engine, etc. Thomas A. Morris, pres't.

Cincinnati, O.—Sealed bids are asked until April 3 for furnishing and delivering water pipe, water pipe specials and loam castings. Robert Allison, pres. B. P. S.

Lexington, Ky.—Bids are asked until May 14, by the Lexington Hydraulic and Manufacturing company, for constructing an earthen dam about 3 miles from this city. S. A. Charles, supt.

Baltimore, Md.—Bids are asked until April 3 for furnishing and delivering such water meters as may be required by the water company during the remainder of the year 1901. A. M. Quick, water engr.

Yonkers, N. Y.—Bids are asked until April 8 for furnishing 1,100 lengths of 4, 6 and 8-inch cast iron water pipe and for erecting a boiler at the low service pumping station. J. C. Shotts, pres. bd. water comm's.

Kenosha, Wis.—Sealed bids are asked until April 2 for furnishing and erecting one vertical cross-compound pumping engine of 4,000,000 gallons capacity in 24 hrs., together with other receiving pipe and accessories. R. H. Moth, supt. W. W.

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Cleveland, O.—Bids are asked until April 3 for furnishing and delivering 50 ft. of 30-inch riveted steel water pipe, 984 ft. of 33-inch riveted steel water pipe, including one 33x30-inch reducer and curve, and one 33-inch curve. Walter P. Rice, dir. pub. wks.

Silver Creek, N. Y.—(Special.)—The S. Howes company invites bids for the supply of a steam power plant of 100 I. H. P. Corliss type engine, and Cahill type upright water tube boiler preferred; induced or forced draft. The bids should be addressed to the company's engineer, M. I. Barbeau.

Cincinnati, O.—Sealed bids are asked until June 18 for erecting three self-contained vertical triple-expansion pumping engines of 25,000,000 gals. capacity each, three of 12,000,000 gals. capacity each, one 30-ton electrical crane, and necessary boilers. Aug. Hermann, pres't bd. of trustees, W. W. comm's.

CONTRACTS AWARDED.

Trenton, N. J.—The contract for a 15,000,000-gal. pump has been awarded to the Barr Pumping Engine company for $56,500.

Detroit, Mich.—The contract for a 60-in. sluice gate was awarded, March 13, to the Russell Wheel & Foundry company, for $1,045.

Spokane, Wash.—The contract for laying water mains on Augusta-ave., between Atlantic and Calispell, was awarded to Ethan Allen.

Ottumwa, Ia.—The contract for building a new water works system was awarded, March 18, to the Fruin-Bambrick Construction company of St. Louis, Mo., for $400,000.

Beaver Falls, Pa.—The contract for constructing a filtering crib in the Allegheny river at Wildwood, to furnish water to Wilkinsburg, North Braddock, Rankin, Swissvale and part of Brighton, was awarded to Campbell & Sons of this city for $53,500.

Louisville, Ky.—Bids were opened, March 9, by the Louisville Water company for the new filters and contracts awarded as follows: U. S. Cast Iron & Pipe Foundry company, Louisville, straight bell-and-spigot pipe, $25 per net ton for full lengths and $35 for fractional lengths; full-length flanged pipe, $45 per ton plus ¾ ct. per pound for facing and drilling; special castings, 4¼ cts per pound for loam, 2½ cts. for others, and 1 ct. per pound for facing and drilling flanged specials. Warren City Boiler Works, Warren, O., three filter tanks, $22,825; standpipe and alumina tanks, $20,195; gate valves, Ahrens & Ott Mfg. Co., Louisville, $11,030 (provisional award). Vulcan Iron Works, Chicago, balanced gate valves, $1,994. Granger & Co., Louisville, electric crane, $32,500; agitator, $16,700. National Foundry and Machine company, Louisville, galleries, stairs, etc., $1,498 (provisional award). Geiger, Fiske & Koop, Louisville, elevator, $2,150. Jos. McWilliams & Co., Louisville, heating plant, $8,533. Two small contracts have not been awarded yet.

BRIDGES.

Medway, Me.—A bridge is proposed across the East branch.

Ashland, Kas.—A bridge across the Kansas river is proposed.

Bayville, N. Y.—A new bridge to replace the old structure is proposed by the town.

Bay City, Tex.—The question of issuing $40,000 bonds for bridging the Colorado river will be voted on April 2. Co. coms.

Topeka, Kas.—The county commissioners have decided to build a bridge across the Kansas river from Fairchild-st.

Boise, Idaho—Bids are asked until April 15 for a steel bridge across Boise river. W. M. Clark, chm. bd. co. coms.

Muscatine, Ia.—Bids are asked until April 3 for all iron bridges to be built during the ensuing year. A. C. Noble, co. audt.

Mittineague, Mass.—Sealed bids are asked until May 1 for building a two-space deck bridge over Westfield river. Co. coms.

Watertown, Conn.—A petition is being circulated asking for a bridge across the Naugatuck river, from this city to Waterville.

Milwaukee, Wis.—Sealed bids are asked until April 20 for building a highway bridge across the Milwaukee river at Grand-ave. Chas. J. Poetsch, chmn. B. P. W.

St. Joseph, Mich.—The question of issuing bonds for the construction of the Michigan-ave. viaduct will be voted on April 1. C. S. Rigby, cy. engr.

Chicago, Ill.—Sealed bids are asked until May 8 for constructing the substructure and superstruction of a bridge across the Chicago river. Alex. J. Jones, prest. bd. trustees.

Lampasas, Tex.—Plans, specifications and estimates will be received until April 16 for two iron or steel bridges to cross Colorado river, between Lampasas and San Saba counties.

Lynchburg, Tenn.—The question of building a new steel or stone bridge to replace the present structure across East Mulberry creek will be considered at the April term of court.

Lancaster, Pa.—Bids are asked until April 4 for building a stone arch bridge in Euphrata twp., and two wrought iron and steel bridges. Daniel E. Mayer, chmn. co. coms.

Niles, O.—The construction of a girder bridge over Mosquito creek is contemplated by the county commissioners, the city council and the Mahoning Valley and Trumbull Electric railways.

Indianapolis, Ind.—Plans have been contemplated for two new bridges across White river at W. Washington-st. and River-ave. B. J. T. Jeup, cy. engr., estimates the cost of Melan arch bridges at $125,000 each.

Lancaster, Pa.—Bids are asked until April 4 for building a stone arch bridge in Euphrata twp., a wrought iron and steel bridge across the Cocalico creek, a wrought iron and steel bridge of 85-ft. span and 16 ft. W. Long, co. com.

STREET LIGHTING.

Sabetha, Kas.—A municipal light plant is proposed.

Nashville, Tenn.—Bids will be asked soon for the proposed new electric light plant.

Independence, Mo.—The question of electric lights will be voted on April 30.

Westerly, R. I.—Municipal ownership of the gas and electric lighting plants is desired.

Frenchtown, N. J.—Bids will be received

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May 1 for constructing an electric light plant. John Hyde, jr.

Burlington, Ia.—Bids are asked until June 1 for lighting the streets for five and ten years. Frank P. Prugh, cy. clk.

Wilmington, N. C.—Bids are asked until April 10 for lighting the city with electricity for one year. A. M. Waddell, mayor.

Richmond, Va.—Bids are asked until May 1 for furnishing 560 arc lights for one year. W. P. Knowles, supt. City Gas Works.

Tipton, Ind.—The city council is making arrangements for installing a new municipal light plant.

New London, Iowa.—The question of changing the street lighting system to electric lighting is being agitated.

Kenosha, Wis—The Citizens' Electric company is being organized here to compete for the lighting of the city.

Aurora, Nebr.—The question of purchasing the present electric light plant or building a new one will be voted on.

Lincoln, Nebr.—The question of issuing bonds for building an electric light plant will be voted on April 2. H. J. Winnett, mayor.

Elmwood, Ill.—A contract for arc lighting has been awarded to the Elmwood Electric Light company, at $4 per month, per light, for five years.

Glenwood Springs, Col.—An ordinance providing for municipal ownership of the electric light and power plant will be voted on April 2.

Albany, N. Y.—The contract for lighting the city with electric arc lamps for five years was awarded March 15 to the Municipal Gas company at 32 cents per ramp per night.

Tacoma, Wash.—The contract for furnishing the city with 150 electric light meters was awarded to the Electric Light Appliance company of Chicago at $10.65 per meter.

Little Rock, Ark.—An ordinance has been passed appropriating $16,000 for the enlargement of the city electric light plant. W. R. Duley, mayor.

St. Joseph, Mich.—This city voted March 4 to bond for $12,000 for establishing a municipal electric light plant to furnish 120 arc lamps for illuminating the streets.

Watkins, N. Y.—A contract for lighting the streets for five years was awarded March 3 to the Watkins Electric Light and Power company at $60 per year, per arc light, and $15 for incandescent lights.

Annapolis, Md.—The Anne Arundel county commissioners awarded a contract March 12 to the United Electric Light and Power company for lighting Brooklyn and Curtis Bay with 32 arc lights of 500 c. p.; to be increased to 60 lamps for $3,000 a year.

Clinton, Ia.—Bids will be asked in April for rebuilding and improving the electric light plant recently purchased by the cty. S. M. Highlands, pres. Clinton Gas Light and Coke company.

The construction of electric light plants is contemplated at the following places: Scribner, Neb.; Conrad, N. H.; Cove, Or.; Plainfield, Ill.; Oxnard, Cal.; Algood, Tenn.; Bolivar, Mo.; Statesboro, Ga.; Poland, N. Y.; Springville, Utah: Butler, Mo.; Trenton, Mich.; Wapella, Ill.; Carver, Minn.; Nashua, N. H.; Emporium, Pa.; Tifton, Ga.; Iuka, Miss.; Dresden, O.; Manton, Mich.

Washington, D. C.—E. M. Dawson, ch. clk. of the department of the interior, is preparing to ask bids for establishing an electric light plant for lighting the patent office building, the old postoffice department, the bureau of Indian affairs and the pension building.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Sault Ste. Marie, Mich.—A method of garbage disposal is proposed.

Dayton, O.—The B. C. A. has about decided to rebuild the crematory. Pres. Herbig.

Erie, Pa.—The joint street committee has asked for appropriation of $8,000 for street cleaning for the year.

Sacramento, Cal.—The clerk of the board of trustees has been instructed to ask for bids for four sprinkling wagons.

Atlanta, Ga.—Bids will be asked at once for collection and disposing of the garbage for one year. Bd. of health.

Spartansburg, S C.—(Special)—F. H. Knox, engr., says the purchase of one street sweeper and one street sprinkling wagon is proposed.

Chicopee, Mass.—Bids are asked until April 10 for the collection of garbage for the year ending May 1, 1902. Rich. D. DeWitt, sec'y bd. health.

Philadelphia, Pa.—Contracts for sprinkling the park drives have been awarded as follows: East Park drive, Wm. D. Miller, $5,630; West Park drive, John Lynch, $7,443, and Wissahickon drive, $1,800.

Indianapolis, Ind.—The contract for sprinkling was awarded March 25 to C. Rust and F. Kennington & Co., as follows: Twice a day, $20.60 for each 10,000 sq. ft.; three times a day, $21.60 for each 10,000 ft. The contract applies to the whole city.

St. Paul, Minn.—The contract for sprinkling districts 4 and 14 have been awarded to Fielding & Shepley, at 15½ and 32½ cents per 100 feet per week, respectively. James Forrestal secured the contract for sprinkling districts, 1, 2, 3, 5, 6, 7 and 8 at 14.67 cents to 16.48 cents per 1,000 feet per week.

Detroit, Mich.—Bids were received Mar. 11 for garbage collection and disposal for terms of 3, 5, 7, and 10 years. The bids were on the basis of collection alone, disposal alone, and the two combined. James Hanley was the lowest bidder on collection, at $31,000 a year, for either three or five years, $31,775 for either 7 or 10 years. James A. Mercier was the lowest bidder for disposal at $20,000, $19,000, $18,000 and $17,000 per year for the several terms, shortest to longest period. For both collection and disposal the lowest bids were as follows: 3, 5 and 7-year periods, respectively, $50,000, $52,000 and $54,000, from J. A. Mercier; for ten years, $55,000, from the Detroit Sanitary company, which now has the contract for disposal by the reduction process. Mr. Hawley's bid for collection, at $31,775 per year, and Mr. Mercier's for disposal at $17,000 per year, making a total of $48,775 per year, would be the cheapest.

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Municipal Engineering

VOLUME XX. MAY, NINETEEN HUNDRED ONE. NUMBER 5.

MODERN METHODS OF SEWAGE PURIFICATION.

The sewerage commission of the state of Connecticut, in its recent annual report, discusses in considerable detail the methods of sewage purification which have been found within the past few years to be efficacious, and those which are now in process of development. Some of these are of direct application to the cities of that state, many of which must shortly take definite steps toward the removal of the nuisances which are produced by their present methods of sewage disposal.

The commission was appointed by the governor of the state in compliance with an act of the general assembly, and continues the work of a commission, operating the previous year under a former act. The business of the commission is definitely stated in these words:

"Section 2. Said commission shall investigate methods of sewage purification and construction of sewerage systems and sewage disposal works; and said commission shall have power to summon witnesses before it with books, papers and maps for any purpose that may appertain to the duties of said commission. The commission may employ from time to time the services of a competent bacteriologist, chemist or engineer, who shall be paid a reasonable compensation, approved by the board of control."

In accordance with these provisions three members of the commission visited England and inspected a number of the experimental stations and the new works completed or under construction, which are the result of the experiments which have been made so extensively in that country during the past five years or more.

The report gives some statement of some of these inspections, selections having been made of material which would be of most value for the local conditions in the state.

The committee visiting England seems to have been most favorably impressed with the results of the experiments at Manchester and reports upon them in considerable detail. These experiments lead to a program which includes screening, passage through a a septic tank, passage through contact beds, two in succession. The conclusions of the Manchester commission in charge of the work are given in full as the most definite and authoritative expression of the practical results of experimentation under Manchester conditions which has yet appeared.

"1. That the bacterial system is the system best adapted for the purification of the sewage of Manchester.

"2. That any doubts which may have arisen in the first instance as to its suitability, owing to the presence in Manchester sewage of much manufacturing refuse, have, through the convincing results of our experimental inquiry, been entirely banished.

"The results obtained have altogether exceeded our expectations as to the possibility of purifying a manufacturing sewage, inasmuch as it was previously a matter of common belief that in such a liquid only a most insignificant amount of nitrification could be induced.

"3. That inasmuch as a bacterial contact bed can only effect a definite amount of purification in a single contact, it becomes necessary, in order to carry the purification beyond this limit, to apply the effluent to a second bed, in which again a further definite amount of purification can be effected. Hence, for obtaining a high degree of efficiency of the bacterial purification of sewage, a system of multiple contact is generally necessary. Thus it may be taken broadly that in the first contact 50 per cent. of the dissolved impurity is removed, and that in the second contact 50 per cent. of the impurity still remaining in the effluent is disposed of and so on.

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"4. In order that a bacterial contact bed may exercise its full powers of purification, it is necessary:

"(*a*) That it should be allowed sufficiently frequent and prolonged periods of rest.

"(*b*) That the sewage applied to it should, as far as possible, be free from suspended matters.

"(*c*) That the sewage applied to it should be of as uniform a character as possible.

"5. The above conditions are secured by passing the sewage as it arrives at the works through an adequate system of screens, catchpits, and tanks. Such an arrangement has the further important advantage of leading to the development of those anaerobic or septic processes which resolve into gaseous and soluble products the organic suspended matter present in the sewage. A large proportion of the sewage-sludge which would otherwise accumulate, and the disposal of which is the source of so much difficulty and expense, is thus abolished. The above anaerobic or septic process is found to take place as effectively in an open tank as in a closed one.

"6. The capacity of bacterial contact beds has been found to remain practically constant after they have been in operation for a period of three months. This capacity is best referred to the empty tanks, the measurement being taken to the line which corresponds to the surface of the clinkers which are subsequently put in. The constant water capacity of the beds has been found on this basis, in round numbers, to be about one-third of the tank capacity.

"7. With regard to the amount of sewage which can be purified by a given bed without the latter being overtaxed, our prolonged experimental inquiry has shown that each bed may safely receive four fillings in the twenty-four hours, provided the sewage has undergone the preliminary subsidence and septic preparation in tanks, and that the bed is accorded about one day's rest in every week. In the event of a bed having been unduly taxed, its efficiency is only temporarily impaired, and can be restored by a few days' repose.

"8. We have shown that storm water may also be satisfactorily dealt with by means of an accelerated bacterial treatment, which can be brought into operation

FIGURE 1. ACCRINGTON, ENGLAND. SEPTIC TANK, FULL.

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as soon as the sewage is sufficiently dilute. As, however, until about two hours after the commencement of heavy rain there is no abatement in the concentration of the sewage, it will be generally necessary to provide for the storage or separate treatment of the first flow.

"9. Our experiments show that the bacterial system of treatment is efficacious at all seasons of the year, the temperature of the sewage being sufficient both to prevent any stoppage of the beds by the formation of ice, and also to maintain the necessary activity of the bacteria even in the coldest weather.

"In view of the experience gained and set forth above, we beg herewith to make the following recommendations:

"1. That the sewage as it arrives at the works be submitted to an efficient process of screening, and that it be then passed through the present open tanks. The tanks should be provided with submerged walls and floating scum-boards, so as to retard the flow of the mineral and organic matters in suspension.

"2. That the effluent from the open tanks be passed through the double contact beds.

"Of these double contact beds we estimate that there should be an area amounting in round numbers to sixty acres, exclusive of retaining walls, roads, etc. This estimate is based on a dry-weather flow of thirty millions, and that each acre, being laid out in beds of 3.33 feet depth, with four fillings per twenty-four hours, would be capable of dealing with half a million gallons of sewage in round numbers, allowing for one day per week rest. The bacteriological or biological beds would be constructed in pairs, high level and low level, of about half-an-acre each, for the purpose of being able to get the sewage quickly upon them.

FIGURE 2. ACCRINGTON, ENGLAND. CONSTRUCTION OF CONTACT FILTER.

"3. With regard to the material most suitable for the bacteria beds, we should recommend that it consist of clinkers, of such a size as to pass a 1½ inch mesh and to be rejected by an ⅛ inch mesh. Efficient means must be provided for rapidly filling and discharging the beds. The beds should be so constructed as to allow of each being used independently.

"4. During the occurrence of a storm the

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flow of sewage should be dealt with in the system of tanks and double contact beds. The excess of flow, after passing through the roughing tanks, should be taken to specially prepared bacteria beds of an area which, we provisionally estimate, will have to be at least twenty-five acres in extent.

"Finally, we may state our confident opinion that with the system of bacteriological treatment of the sewage of Manchester, set forth above, an effluent will be produced which will not only conform with

FIGURE 3. ACCRINGTON, ENGLAND. CONTACT FILTERS, WITH SETTLING WELL AND EFFLUENT CHANNEL.

the Mersey and Irwell standard, but which will also materially improve the condition of the ship canal. Furthermore, as this system does away entirely with the use of chemicals, and at the same time to a very large extent reduces the volume of the sludge to be dealt with, it is obvious that much of the present expense will be saved by its adoption, and this saving may be taken as a material set-off against the cost of the construction of the proposed works."

The application of a similar program at Accrington is meeting with success. The process of chemical precipitation which was formerly in use proved to be totally inadequate to meet the demands of the local Government board, and has been displaced for septic tanks and contact filters. Some photographs of these works were procured by the committee and show details of construction and management better than descriptions can. Figure 1 shows the surface of the open septic tank through which the sewage flows after a thorough screening and in which nearly all the suspended organic matter is destroyed. The characteristic heavy scum of the septic tank is shown, the cracks, giving the appearance of drying mud, being clearly shown in the picture. That it is not necessary to cover the tanks and exclude the light is shown by the successful working of this open tank. The climate of England is not so severe in winter as that of much of the United States, so that the effect of cold upon the action of the septic tank is much more pronounced in this country, and special methods of keeping up the bacterial action in winter may be necessary in some cases. From this septic tank the sewage flows to the contact filters.

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Figure 2 shows one of these filters under construction. The open brick walls to support the coke used as filtering material, the drains and the floor are clearly shown. Figure 3 shows the filter full of coke and also the settling well and effluent channel. The plan of the filter is approximately a circle, to suit the patented method used for distributing the sewage over the bed. The effluent from the septic tank falls four or five feet in a thin sheet for aeration and is then raised by pulsometers and forced through the for some time. The effluent not being satisfactory, it is now run through a contact bed, the construction of which is shown in Figure 5. The floor is covered with tiles as shown, which are set so as to leave some inches of space below them. On these tiles the coke for the filter is spread. The effluent from the precipitation tanks flows by gravity through the pipes shown and out through holes in the top of the pipes, thus spraying the liquid over the surface of the coke.

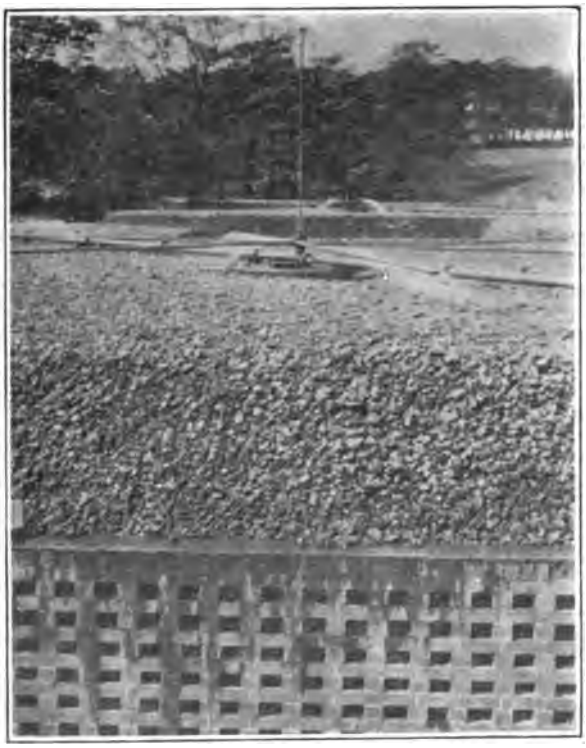

FIGURE 4. ACCRINGTON, ENGLAND. CONTACT FILTER IN OPERATION.

automatic revolving sprinkling device shown in Figure 4, which distributes the sewage uniformly and intermittently over the surface of the bed. The alternate filling and emptying of the contact bed is not necessary under this method of applying the sewage, and a single bed is sufficient. The sewage of Accrington is more concentrated than any other in England and consequently much more so than any in this country, but it seems to be taken care of by the process in use with entire satisfaction.

At Salford the sewage has been treated by the method of chemical precipitation

At Wimbledon the chemical precipitation process is also in use and the effluent is now further treated in a contact bed, a view of which is shown in Figure 6. The bed is very large and in the illustration is shown to be flooded. This bed is operated by the intermittent system described above for Manchester.

The summary of the conclusions of the Connecticut Sewerage Commission regarding sewage disposal and their general recommendations to Connecticut cities and towns will be found on page 223 of our April number. They are generally applicable to

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many cities and towns throughout the country.

The commission has investigated the conditions in several cities of the state as a part of its duties under the statute and has responded to their requests for advice as to methods of procedure. The evident care taken and time consumed in the necessary investigations is evidence of the interest of the members of the board in their work and an earnest of the valuable service which it can give to the cities and towns of the state if supplied with sufficient funds to undertake the desired investigations and experiments and employ the necessary experts and assistants.

SOME EXPERIMENTS IN LAYING BITUMINOUS MACADAM.

The early success of so-called tar macadam pavement at Hamilton, Ontario, has been reported several times in the pages of MUNICIPAL ENGINEERING, and some statement of its use in various forms in other places has also appeared. Mr. Fred J. Warren's article last month on "Coal Tar for Paving Uses," discusses in some detail the reasons for believing that there is a basis for a material success in laying such pavements. The economic value of the project, if successful, lies in the fact that a good pavement for light traffic streets can be constructed on this general plan at a cost which will not be prohibitory even on streets where the property is of little value. The pavement will take a position intermediate between the gravel street and the hard pavement in cost, perhaps between the gravel and the ordinary well-constructed macadam pavement, and promises to be fully as durable as macadam and more satisfactory for most purposes on such light traffic streets than gravel or macadam on the one hand, or brick, asphalt or wood on the other, though for different reasons.

Mr. Warren considers that the city of Hamilton has made a mistake in separating the stone used into varying sizes, placing the larger sizes at the bottom and building up with progressively smaller sizes to the wearing surface, believing that the necessary dependence upon rolling and traffic to make a solid roadway, with the consequent grinding and displacement, will shorten the life of the pavement. The greater voids existing in the stone thus separated, also, according to his observation, shorten the life of the bituminous cement. According to his theory, therefore, the sizes of the particles of stone should be carefully graded and thoroughly mixed, to fill their own voids as fully as possible.

On the 9th of April some experimental sections of bituminous macadam roadway were laid under Mr. Warren's direction at the factory of Warren Brothers Co., in East Cambridge, in the presence and with the advice of fifty or sixty city engineers, street commissioners and officials of cities and towns in Massachusetts and other New England states.

These experiments were made under disadvantage in several respects, notably the wet weather on the day of the experiments and for several days previous, and the poor quality of stone obtainable at this season of the year, the plants in the vicinity being closed for the winter. The stone used was of a pudding stone variety from the Dorchester district and was not considered satisfactory by Mr. Warren. The theories upon which the plan for the construction was based were stated to be, that the subfoundation should be porous and furnish proper drainage, and that the depth of foundation could be reduced from that required in building macadam roads because the surface would be waterproof, and the amount of water to be taken care of by the foundation would be less than with more porous surfaces.

The roadway was built upon ground which had been filled about twenty feet within a few years over low ground containing much water. An excavation twelve inches deep was made, the bottom of which was not solid enough to carry a roller. Six inches of cinders was filled in and rolled with a fifteen-ton roller. On this was laid four inches of the broken pudding stone ranging in size from 1 inch to 2½ inches. This layer was rolled and the stone used was ground under the roller to a considerable extent owing to its character. The rain made all this construction very damp, and unfavorable for uniting with the bituminous concrete.

After rolling, the surface received a thin coat of a relatively soft bitumen whose trade name is chemical tar, all the light oils being removed. This coat was used because the stone was so cold and damp that it might not unite well with the coat of relatively hard pitch which was then sprinkled over the surface and was intended to bind the

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stone firmly together and make a waterproof surface. The use of the intermediate chemical tar coat was intended to insure proper union under the unfavorable conditions of the day.

On top of this foundation was laid a binder or a wearing surface, nine different formulæ being used on various parts of the roadway. In most cases the binder course was left as the wearing surface. In one case stone two inches in diameter was used, progressively smaller sizes being used including a 15-ton roller before adding the bituminous top.

Various quantities of the bituminous cement were used in the various formulæ. Part of the area was surfaced with a thin layer of very soft bituminous sand concrete; part with a very thin and soft wearing surface using part stone screenings with the sand. These soft surfaces were laid ½ to 1 inch thick, and fine gravel, grit or stone chips were rolled into them until they became solid. A large part of the work had

FIGURE 5. SALFORD, ENGLAND. CONSTRUCTION OF FILTERS.

all sizes from 1 inch to 1-200 inch and about one per cent. of dust that would pass a 200 mesh screen. The mixture of these sizes reduced the voids in the stone down to 10 to 15 per cent. of the bulk before bitumen was added. In other cases the same mixture with 1½-inch stone as the largest size was used; in others 1-inch stone as the largest. In all cases the mixture of sizes was adhered to as essential to durability of bituminous matter and of pavement, the voids being reduced to the lowest per cent. possible with the facilities at hand. These layers were rolled with a 2½-ton and with no surface put on but was flushed over with a thick coat of a macadam composition into which fine grit was rolled, making an impervious top with a good foothold for horses.

This macadam composition was specially prepared from selected tar and refined with a view to removing as much of the naphthalene as possible, thus giving the bitumen as great a range of flexibility as can be secured. The composition used in all parts of the binder and wearing surface was so flexible that, in its pure state, it would run slowly from the 3-inch bunghole of a barrel.

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Hardness of surface was acquired entirely by carefully grading the mineral grains, the theory being that all voids should be thoroughly filled with a slight surplus of permanent bitumen and that the bitumen should be so soft that it would, when confined in a carefully-selected stone, require twenty to forty years to reduce it, by natural processes, to a pitch of such hardness that it will crumble. Mr. Warren claims that the life of the roadway will be measured entirely by the amount of wear the stone

FIGURE 6. WIMBLETON, ENGLAND. COKE CONTACT FILTER FLOODED.

used will stand, when it is held in place firmly by the bituminous cement. The roadway, he claims, can be surfaced, from time to time, with a thin flush-coat, and in this way, life added to the exposed part, preventing it from becoming brittle.

If it is possible to confine a hard trap-rock in place with a flexible and water-proof bituminous cement and place the wear almost entirely on the stone, there is some ground for claiming that this form of roadway will be very durable.

It is proper to say that the life of such work will probably depend, for light traffic streets, on the life of the bituminous materials used, but if Mr. Warren's statement is correct, that properly selected coal tar bituminous cements of about the grade and consistency used in the macadam have developed a life of forty years in some cases, then this form of pavement may have great economic value.

The question arises, will the large stones be displaced by horses' calks? Mr. Warren says if they are, use the mixture mentioned above as a permanent binder and keep it covered with a thin flexible and soft wearing surface, so soft that were it two inches thick it would cut all to pieces; by laying it only a quarter to one-half inch thick he claims it has not enough body to cut up and calks will only dent it. A flexible and fine grain bituminous surface, he claims, has been demonstrated to stand travel for many years and show practically no wear. The trouble in the past has been to unite a flexible surface to a hydraulic concrete base. The surface has pushed under traffic. With a bituminous base the surface unites to the base.

The machinery used was a paving plant

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especially equipped for making sidewalk bituminous mastics. A Ruggles-Coles dryer that could pass no particle over 1 inch in diameter was used for heating. All larger sizes were therefore mixed in cold. An ordinary Dietz mixer, such as is used in asphalt plants, with a part of the teeth removed, was used for mixing and a steam jacket kettle for keeping warm the bituminous composition.

None of the material in the mixture was heated to a temperature over 200° F., and the work was based apparently received the approval of the practical road builders present and the outcome of the experiment will be watched with much interest. The attack of so interesting a problem as this in the manner described is worthy of attention, and whether the roadway is successful or not, the effort to reach the valuable truth in the theory is worthy of great commendation. Several of those present expressed their intention of laying some pavement on this plan during the year.

MECHANICAL SCREEN FOR MACADAM MATERIAL.

much of it was laid at as low temperatures as 125°.

The roadway was thrown open to teams on the next day, and is reported to stand the 20 or 25 heavy loads a day which pass over it without marking. Mr. Warren reports that a wagon loaded with 7,500 pounds of sand stood on the pavement in the sun for 30 minutes on the second day after it was laid, and the wheels made no impression.

This seems to be the first piece of pavement laid on the principle of using stone of predetermined variation of size and completely filling the voids, the stone being larger than ¼ inch. The principle on which

An interesting piece of apparatus devised to arrive at a quick result in determining the size of the grains of sand or stone is shown in the illustration accompanying. It will be recognized as a set of screens fastened together and arranged to be shaken by machinery. The screens are 1, ½, ¼, 1-10, 1-20, 1-30, 1-40, 1-50, 1-60, 1-80, 1-100, 1-200 inch in order. Assuming that any even-sized grain yields from 40 to 50 per cent. of voids, a result can be obtained by measure in ten minutes after taking sample. For most accurate determinations weights must be taken, which will prolong the operation about an hour. A stone properly graded for bituminous macadam, according

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to Mr. Warren's theory, will increase in volume about 30 per cent. when separated into the varying sizes by the screens, 1,000 cubic inches becoming about 1,300 cubic inches.

CAMBRIDGE STREET WORK.

Under the efficient management of Charles A. Brown, the superintendent of streets, the streets of the city of Cambridge, Massachusetts, are being brought to good condition and are kept clean. A number of features new to the department have been adopted recently in methods of street cleaning with great advantage to the work and with complete satisfaction to the authorities. The accompanying illustration shows the types of machines in use. The first machine in the line is the gutter sweeper of the Automobile Street Sweeper Company, drawn by two horses moving at a fast walk. The brushes, placed vertically, are made to revolve rapidly and throw the dirt from the gutters into a windrow about three feet from the curb, the corners and sides of the gutters being cleaned as thoroughly as with a house broom. There being no weight of dirt to carry and no unloading, the machine is light and can move steadily along ahead of the pick-up machines which follow. These machines sweep a space seven feet wide and the dirt receptacle has a capacity of about one cubic yard. When filled it can be dumped either on the regular dump or on a side street, the pile of sweepings to be removed later in wagons. Four of these machines are in use. Three steel side sweeping machines have also been kept on duty night and day sweeping the paved streets. A very large item of expense has been the refilling of sweeping machine brooms. After mature consideration the street superintendent has come to the conclusion that this work can be done by the department at half the cost of the present method. The apparatus necessary will be ready for the summer's work and is expected to reduce this item of expense materially, the cost of this apparatus being very small. All the machines mentioned were purchased last year at a cost of $3,500, about ten per cent. of the entire amount paid out on account of cleaning streets.

Some views of the work of brick street construction were given in our April number in illustration of Mr. Tarrant's article on "Modern Brick Street Construction." Another view is given herewith showing the operation of laying brick and rolling them with a light steam roller. A novel use of the heavy roller, provided for rolling subgrade, is shown in another illustration, the complete removal of a tree trunk and its roots being comparatively easy.

EFFICIENT MANAGEMENT AND MAINTENANCE OF WATER-WORKS OWNED BY MUNICIPALITIES OR PRIVATE CORPORATIONS.

By Benjamin L. Williams, Jr.

Efficiency in the management and maintenance of a water-works system, especially a small one, is one of the problems which confront a large number of municipalities and private corporations. Since almost every plant ever installed has been bonded or mortgaged for all it is worth to build it, both municipalities and corporations are somewhat handicapped by a rather healthy interest account. This is usually large enough to eat up all the profits for the first ten years at least, and as the growth of a water-works is necessarily somewhat slow, it takes a number of years to get rid of the interest octopus. Yet with few, if any exceptions, every water-works can be made a source of profit to its owners, and it only remains to apply a few simple, but most efficient rules to place the plant on a paying basis.

In order to operate a plant successfully it is necessary to employ a superintendent who is a good manager and has business and mechanical ability enough to be able to cope with the difficulties which may arise, of which, in a newly-built works, there are not a few. Too often a man is employed at five hundred dollars a year and is expected to do a thousand-dollar job. This is false economy and in a great many cases is one of the secrets of the failure of the plant to give the proper returns. If the governing bodies

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CAMBRIDGE, MASS., GUTTER SCRAPER AND PICK-UP MACHINES.

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would take this into consideration there would be no cause for the general inquiry, "Why don't our water-works pay?" The solution of the problem is directly under their thumbs, but they do not seem to realize that the employment of a man who is up-to-date and a hustler is the first step to success, but as a rule run along in a slip-shod manner. While this is very much to be regretted, yet, nevertheless, in a great many cases, it is so.

However, we will assume that a man does get what he is actually worth, or at least a living salary, and he has the support of the governing bodies, but on account of the partial isolation of his town from the larger cities, he is somewhat in the dark as to just what he should do to get a better return for the investment, or just what methods are employed elsewhere to place a plant on a paying basis. With a plant supplied by gravity pressure the solution of the problem is a compartively simple one, and with the pumping pressure the main features would also apply. The first step would be the installation of a large meter or meters on the supply at a point on the outskirts of the town, the purpose of these being to detect leaks on the large mains, which in a new plant is a large item, and should, therefore, be cared for immediately. This is very important, and no delay should be made in repairing them. The next step would be to decide upon a meter rate for the consumers. This is a difficult matter with some places, but it is possible to do it, although the method may vary in different localities. Then install meters on every tap made. Thus far the expense of the meters and their installation will have been partially paid for by the detection of leaks on the large mains, and the prevention of waste by the consumers on the services, which is as great, if not the greater item of the two.

The systematic flushing of the mains through the summer would improve the supply and keep the plant in better shape. What I mean by flushing is to flush, not open a hydrant a quarter way and allow the water to run to waste for a week, but to open the hydrant *full* and let it run until the water is clean. This takes about ten or fifteen minutes ordinarily, and gives results without the waste of water. The elimination of dead ends would reduce the necessity of flushing so often, but as this can hardly be expected in a large number of localities, the observance of the above suggestion would be of value.

The comparison of the large and small meters will tell where the water is going, and, in order to make this a success, the large meter should be read at least three times a week, or more frequently if possible. It will be noticed that there is an average daily consumption, and should the meter show more than this, then it is time to go out and look for trouble, keeping in mind the most likely place where it would occur, and when found, to settle it at once.

All bills should be rendered quarterly, whether for fixtures, of which there should be very few, or meters. This would call for the inspection of the entire plant once in three months, which, coupled with the interest a man should take in his work, would be sufficient to detect any irregularities which may occur. The close collection of accounts is a most important matter and is too often the stumbling block in municipal ownership. It is as great a problem as that of keeping the supply down to a minimum; the methods to be employed are a pleasant but insistent manner and business tact, and this coupled with the support of the higher officers will soon get the consumers in the habit of paying promptly.

The establishment of the rules and regulations, is a matter to be considered very carefully. And when they are established, *enforce them*. This is of extremely great importance and on this alone a great part of the efficiency of operation depends. Unfortunately in municipal ownership, politics are allowed to take such an active part in the management of the plant, as to almost totally prevent it, whether the town is small or large. Mr. L. N. Case hit the nail on the head when he said "To be successful, municipal ownership must be real, not simulated; it must be public ownership complete—not private ownership by public officials." If this is not impossible, the responsibility of the successful operation of the plant devolves upon the superintendent. And if he is a man who takes pride in his work there is no doubt but a great many of the small plants, and some of the large ones, too, would receive very different returns from what they do now.

To sum up, the efficiency of a plant depends upon the closest attention to details, the installation of meters, both on the service and supply, the comparison of them at stated intervals, the rendering of accounts quarterly, the close collection of the same, the enforcement of the rules and regulations, the keeping in touch with all the details of the works, the systematic flushing of hydrants; in short, the conscientious discharge of his duties by the superintend-

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ROLLING BRICK PAVEMENT WITH TWO AND ONE-HALF TON STEAM ROLLER, CAMBRIDGE, MASS.

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ent, the support of the superintendent by the higher officials, and in cases of municipal ownership the total elimination of politics.

In municipal ownership the establishment of lower rates to the consumer necessarily follows, after it has been proven that a plant can be operated on a paying basis at a minimum cost and in private ownership a greater source of profit to its owners, which are the results sought for.

EDITORIAL COMMENT.

Freight Rates on Cement.

The extension of the territory in which cement can be manufactured is very rapid, as the increase in its use convinces capitalists that there is money in the manufacture of the material, and the experts are set to looking for suitable materials where business considerations indicate that it is desirable to locate mills. It was long thought that good American Portland cement could not be manufactured except in the Lehigh region, though there had been a few more or less successful attempts in other parts of the country with other materials. But further successful experimentation with marl and clay has led to a large increase in the works using these materials in Ohio, Indiana and Michigan. The presence of unusually pure limestone in the neighborhood of the same region has led to the use of limestone and clay, and this in turn has largely increased the possible field for the location of cement works. Thus nearly every state in the union, with reasonable density of population, which has these materials of proper quality, is now provided with one or more cement mills, turning out Portland cement of some quality, and the projected works will soon fill out the gaps in the list.

It is evident, therefore, that the freight rates on cement are of great and increasing importance as factors in the competition for trade and will often turn the scale for or against a certain brand. When brands are equal in quality and in cost of manufacture, the one whose freight rate is the least will make the sale. When a poorer brand comes into competition with a better, this question should not have so great weight, and a careful study of the two brands will show their relative economy, in case either is safe to use, and thus show which should be chosen. The collection of evidence concerning the quality of materials, the character of process of manufacture, the care taken and the treatment after manufacture, as well as the consideration of the results of tests, physical or chemical, are thus becoming more essential to economy in purchase of materials. The large number of new brands make this collection and consideration also necessary to distinguish the good cements from those which are made with less care from hastily selected materials by less competent operatives.

As will be seen from an examination of the descriptions of cement works in the Directory of American Cement Industries and Hand-book for Cement Users, nearly all of the new works are designed to follow the same general program of operations, the details being modified for the variations in materials and the particular machinery adopted, so that if due attention has been paid in the location of the works to economy in handling raw material, the cost of cement at all well managed mills should be very nearly the same, or at least should vary only with the nature of the raw materials, thus dividing the cements into two or three classes on the basis of cost of manufacture. Reasonable profit and freight charges added to this cost will give the cost of cement delivered. Under such uniformity of conditions, freight is an important factor.

A valuable feature of the Directory is a table, prepared largely by the Interstate Commerce Commission, giving freight rates from the important centers of cement manufacture in the states from New York to Wisconsin, to about forty centers of distribution scattered over the country. This table will be found valuable in other ways than to determine that the freight rate from Allentown, Pa., to Memphis, Tenn., is 32 cents a hundred pounds in carload lots, though this is the most obvious and perhaps the most valuable use.

The most striking feature is the clearness with which it shows the prohibitory nature of the freight rates upon the sale of cements from a distance if the cost of cement alone is to be considered, and the great advantage which home-made cements have in this regard.

This would show more clearly if the list of cement factories included those in the Dakotas, Colorado, Utah and California. A reputation for making good cements for all purposes will put local factories in such instances in command of the market to the exclusion of all American or foreign brands.

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REMOVING TREES WITH STEAM ROLLER, CAMBRIDGE, MASS.

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Another feature of interest is the showing of the comparatively slight difference in freight rates from the important districts where cement is manufactured to the distributing points. Even in such cases as the rates from the Lehigh district and from the Michigan district to Chicago, the difference is but 40 cents a barrel, approximately, while in almost all other cases it is materially less. Greater economy in manufacture may easily enable a distant competitor to undersell a nearer cement of equal quality. Reference may be made to the table for other points of interest. It will be ready for delivery a very few days after the receipt of this number of MUNICIPAL ENGINEERING.

Stream Pollution. A New Jersey jury has given a verdict for $3,000 in favor of an ice company against the city of Paterson apparently on the ground that this was the value of ice, the sale of which was destroyed by the sentiment against its use on account of the pollution of the stream, rather than because any actual damage to the ice was proved. Whether the higher court will sustain this verdict is a question which will probably be decided later.

The supreme court of Wisconsin has affirmed the decision of a lower court enjoining the city of Waukesha from discharging unpurified sewage into a stream and granting a jury trial to determine damages for injury already sustained. The statement by Judge Dodge of the grounds on which the decision is based is the clearest statement of them which has yet been made. It is as follows:

"We can not but recognize that as the density of our population increases, as our citizens engage in new and greater industries, and as the municipal aggregations of population multiply and expand, the original purity of streams and water basins can not be wholly preserved. They are the natural and unavoidable courses and receptacles of drainage, through and into which must flow the refuse of human habitation and industry. How far these changing conditions must bring about a yielding of the private rights of continued purity of those lakes and streams to the necessity of use thereof for the public and general health and convenience, and upon what terms such yielding shall come, are primarily questions of policy for the legislature, within the limits of its power over private rights defined by the constitution. When, if ever, the legislature shall enact that streams generally or any streams shall be used as sewers without liability to the owners of the soil through which they run, the question of constitutional protection to private rights may be forced upon the courts for decision. Until such enactment is made, however, in clear and unambiguous terms, we shall be slow to hold by inference or implication that it has been made at all. The right of the riparian owner to the natural flow of water substantially unimpaired in volume and purity is one of great value and which the law nowhere has more persistently recognized and jealously protected than in Wisconsin. Not alone the strictly private right, but important public interests would be seriously jeopardized by promiscuous pollution of our streams and lakes.

"Amid this conflict of important rights, we can not believe that the legislature concealed, in words merely authorizing municipalities to raise and expend money for the construction of sewers, a declaration of policy that each municipality might in its discretion, without liability to individuals, take practical possession of the nearest stream as a vehicle for the transportation of its sewage in crude and deleterious condition. The authority granted to municipalities is to construct sewers, but subject to the general legal restrictions resting upon such corporations forbidding invasion of private rights by the creation of nuisance or otherwise. This view of the legislative purpose is enforced by the consideration that although liquid sewage must flow off along the general drainage courses of the vicinity, it is by no means physically necessary that it should carry with it the solids in an offensive or unhygienic condition."

Partial consideration of the question, concluding the argument before reaching all the points stated above, has caused the peculiar decisions in an Indiana case and in two or more New Jersey cases. That courts and juries in New Jersey do not agree is shown by comparing cases reported in these columns in this and preceding months. Such arguments as the one by Judge Dodge will go far toward establishing the basis for all decisions on the subject of stream pollution, and will reduce the variation in decisions, which is now the most striking feature in litigation upon the matter.

Road Repair. The Illinois Agricultural Experiment Station, at Urbana, Illinois, has issued a bulletin, written by Professor I. O. Baker, of the University of Illinois, on the "Construction and Care of Earth Roads in Illinois," which puts into classified and complete form the practice

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of the best road repairers of the state, and is so clearly stated that the farmers, for whom it is intended, can, if they wish, follow the instructions given with great advantage to the earth roads of the state. The bulletin has gathered together the ready methods developed in the field, and if it is used as a guide the roads will be greatly benefited. Forty years of similar instruction has, however, had little effect upon the condition of the roads in comparison with the amount of money expended upon them. There are two interacting causes for this; one, the slight interest actually taken in improvement of roads by the average farmer, and the other, the slipshod system of road supervision and repair. The removal of either one of these drawbacks will practically remove the other. Instruction by newspaper, bulletin, lecture, or discussion has little or no effect upon either, if judged by actual results, and Professor Baker's bulletin is not likely to have any appreciable effect, notwithstanding it is as clear and complete a code of procedure in road repair as has been prepared.

Practical application in other countries and theoretical conclusions in this indicate that no material advance can be expected until the management of road repair is put into the hands of intelligent supervisors who are given sufficient power and are held responsible for the condition of the roads in their charge. College graduates are not necessary for this work. Almost every township has more than one man who would make an ideal road supervisor, if he were put under some central expert direction or source of advice and the methods of procedure were so changed that he could be actually in charge of the work, and held responsible for its proper performance. Such intelligent direction of the work will keep the roads in much better repair for the same time and money expended; such improvement in roads will elevate public opinion on the subject, and substantial progress toward good roads may be expected. The ordinary earth road is not a good road, notwithstanding the fact that it is at times the best road imaginable. No road is a good road which fails at any season of the year; certainly none which is actually impassable, even for a day, on account of its condition as a whole. In can be made to approximate much more closely to a good road if Professor Baker's suggestions are followed, but they will not be followed unless more central and expert authority and more responsible and thorough supervision are provided.

The Indiana legislature has just established a form of road supervision under the county council as a central authority and with district supervisors appointed by them. Each supervisor has charge of not less than ten nor more than fifteen miles of road. The system is applied to gravel roads but it can be applied to all county roads as well, so that its success or failure under the conditions of the statute will be of value in further consideration of the subject.

Water Meters. The paper by Mr. A. L. Holmes on the "Cost of Installing a Water Meter System," in another column, gives some practical discussion of an important question in water-works management and information of much value regarding the cost of installing a meter system which should aid water-works officials materially in developing favorable public opinion. Mr. Holmes' argument in favor of charging the cost of meters and setting to the water-works is a good one. It might be made more definite in one respect, and the charge made to capital account, for all the evidence shows that the application of meters diminishes the demand for water, on account of diminishing waste and unauthorized uses, and thus reduces the capital investment required. The comparatively small investment in meters should be counted as a partial offset to this reduction in capital account. The reduction of course takes the form usually of a postponement of the time when an increase in capital account must be made.

Mr. Holmes' examples of the saving by the introduction of meters are from the smaller cities. Hartford City, Indiana, increased the number of taps about 25 per cent. from 1898 to 1900, none being metered the former year and all being metered the latter year. At the same time the consumption of water was decreased about 12.5 per cent. Notwithstanding this reduction in the amount of water supplied, the revenue increased about 80 per cent. With the saving in pumping expenses, this would almost pay the $5,500 cost of installing meters in one year. The increase in the revenue per tap from $5.74 in 1898 to $8.51 in 1900 would indicate that the cost of water to consumers is materially greater under the meter system than before the meters were introduced. This is not the usual experience, nor is it one which will make the introduction of meters popular. The large increase in revenue, coupled with the material decrease in consumption, indicate that the meter rates are too high for the local cir-

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cumstances, that a judicious reduction should be made in the interest of the consumers, and that the revenues of the works are sufficient to warrant this reduction. This is true, notwithstanding the revenue per tap is well below the averages given below.

Mr. George I. Bailey, superintendent of the Albany water-works, has compiled a table from information gathered by him for its bearing upon this subject of the use of water meters, which covers most of the cities of 25,000 population or more in the country. The columns of interest in this connection are those giving the consumption per capita and the percentage of taps metered. To show the effect of meters upon consumption Mr. Bailey has made averages which show that when less than 10 per cent. of the taps are metered the daily consumption averages 153 gallons, ranging from 32 to 300, or more justly, from 62 to 280, the outside figures being abnormal; when 10 to 25 per cent., 110 gallons, ranging from 56 to 225; when 25 to 50 per cent., 104 gallons, ranging from 46 to 273: when more than 50 per cent, 62 gallons, ranging from 29 to 120. An examination of the table in detail indicates that the averages are fair indications of the relative standing of the various classes, and the number of cities in each class is large enough to give weight to the result. The average consumption of all the cities in the table, 136 in number, is 137 gallons per capita. It is thus seen that with practically no meters in use the consumption is 12 per cent. more than the average, and in cities with more than 50 per cent. of the taps metered, the consumption is less than half the average. The seventy cities in the class with less than 10 per cent. of taps metered overshadow the others in the average of all, which shows still more clearly the beneficial effect of meters.

While there are many more independent variables in the determination of the receipts per consumer in the various cities, a consideration of this column may have some interest. In the fifty cities reporting this item who have less than 10 per cent. of taps metered the average revenue per consumer is $2.50, or $15 per tap on Mr. Bailey's assumption of six consumers per tap. The range is from $1.14 to $4.92. In the twelve cities having from 10 to 25 per cent. of taps metered the average revenue per tap is $2.29 per consumer, or $13.74 per tap, the range being from $1.19 to $3.34. In the sixteen cities having from 25 to 50 per cent. of taps metered the average revenue is $2.85 per consumer, the range being from $1.11 to $8.87. There are two extra large results in this list. One, $8.87 is for Duluth, whose rates have since been reduced 20 per cent., and the other $5.06 is for Springfield, Mass. If these are omitted, the average revenue for the fourteen remaining cities is $2.26 per consumer, or $13.56 per tap, and the range is from $1.11 to $3.33.

In the twenty cities having more than half their taps metered the average revenue per consumer is $2.43, or $14.58 per tap, the range being from $1.32 to $4.25. There is here a slight though definite indication of a decrease in cost of water to the consumer paying the meter rate. In some instances it is undoubtedly true that the meter rates are fixed too high when meters are first introduced, and they can be materially reduced later. If so, the reduction in cost of water to consumers will show more clearly in later reports.

Uniform Municipal Statistics.

The National Municipal League holds its next meeting at Rochester, N. Y., on May 8, 9 and 10, and will devote much time to the discussion of uniformity in municipal accounting. The program includes a report of the league's committee on this subject, including a discussion of tentative schedules applicable to financial reports of cities; papers on municipal statistics and methods of securing uniformity in England, Germany, France and Italy; present conditions in the United States, and what steps can be taken to better conditions. The afternoon of the 10th is specially devoted to this subject.

A request has been sent to the members of committees of other societies upon the same and related subjects to meet with the league, and to join in a conference of committees on Saturday, May 11, at which it is proposed to discuss the proposed schedules, the extent to which uniformity can be and should be attempted, the practicability and methods of securing favorable action by the city, state and federal authorities.

There is at present urgent need and a strong demand for uniformity, and concerted action will undoubtedly be productive of beneficial results. Several cities have already signified their willingness to adopt the uniform scheme, and an opportunity is now open to accomplish much.

It has now been nearly five years since the American Society of Municipal Improvements began the agitation of its particular branch of the general question, and so far as correspondence with other societies

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working in the general field is concerned, there is but little more interest in the subject than at that time, the Committee of the National Municipal League excepted. A good attendance of the members of such committees as have been appointed is much to be desired and would undoubtedly result in material increase in interest. Unless attending the League meeting, however, and present on this account, a reasonable representation of the societies which should be interested is doubtful.

One reason for the lack of interest in many of the societies is the fact that their membership is nearly all outside the work which it is desired to regulate, and aside from the lack of personal interest there is the innate dislike to seem to interfere with the business of others in which one is not personally interested. The movement is in the interests of good government and honest administration of it, however, and as such should be of personal interest to every voter and tax-payer. In the most thoroughly technical branches of city work will be found the most interest in some particular branch of the general subject, but those are the departments in which there is the least need of opening up methods and accounts to the light.

THE QUESTION DEPARTMENT.

CONCRETE BLOCK FOR STOP-BOX.

In this city we have sometimes run considerable stretches of small pipe to reach a customer removed some distance from our cast iron mains. For this purpose we have used galvanized pipe, as it would not pay to use anything more expensive. Most of our streets are not paved and we find that a stiff road-box placed over a valve in the galvanized pipe line is unsatisfactory in that it imparts a shock to the small pipe when the box is struck by a wagon. Consequently we wish to use a telescopic box. In the course of time, however, these boxes gradually work down below the level of the soft streets, and are difficult to locate. We therefore desire some device to hold the top of the telescopic box level with the street surface. The outside diameter of the box may be as much as two inches. We are wondering if we can make a cement or concrete block, round or square, with hole in the center to admit the body of the box, after which the top will be screwed on. This concrete block will have to be strong enough to stand weather and the occasional impact of a wagon wheel. It would not be exposed to steady travel—in fact very little—but might occasionally be struck by a wagon wheel. We would expect to imbed it firmly in the soil, even with the surface. What we wish to know is what thickness and size in other dimensions to make this block in order to stand the conditions noted, and the proportions of sand, cement and gravel.

Henry Lautz,
Sec'y Water-Works Co., Pekin, Ill.

The construction proposed should be satisfactory, if a block about two feet square is set as described. The foundation should be about four feet long in the direction of traffic and somewhat wider than the block. The block should be sloped down in each direction from the surface to the outside of the foundation, so that at the outer edge it is six inches or more below the surface, so that wheels approaching in the mud will strike this sloping surface rather than the edge of the block. The surface of the center of the block should receive a slight crown in the direction of traffic, not more than an inch or so. The block should be laid according to the specifications for concrete street crossings in the "Directory of American Cement Iudustries and Hand Book for Cement Users," making a foundation of several inches of broken stone or gravel, covered with four to six inches of cement concrete made in proportions of about one part first-class Portland cement, three parts sand and six parts broken stone, finished off with a top one or two inches thick of one part same cement and one and one-half parts hard, coarse sand. The block should be laid all at one time, that there may be thorough bond between the courses. See this department for April for answer to question on construction of street crossings.

CEMENT SIDEWALKS.

I would like reference to articles on the construction of cement or artificial stone sidewalks.

L. N. Howe, St. Charles, Minn.

Where can I procure the standard method of laying artificial stone pavements, and information about the tools required in connection with the same?

B. H. Nicholas, Philadelphia, Pa.

Can you inform me how to mix and lay cement walks and curb, and what is used to give the cement different colors; also, what a set of tools for doing this kind of work will cost?

L. D. Clark, Lakeport, N. H.

Can you refer me to specifications for cement concrete walks and crossings?

R. P. Drake, Village Clerk, Humphrey, Neb.

See pages 16, 23, 24, 86, 427, of Vol. XIX of MUNICIPAL ENGINEERING, July–December, 1900. "The Directory of American Cement Industries and Hand-Book for Cement Users," which will be issued from the press in a few days, will give full details of the methods of mixing and laying cement walks and curb, as well as of securing

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cement which will give good results. It is the most complete book on the practical use of cement yet prepared. The coloring matters used are fully described with proportions. See, also, the short article on colors for concrete in this number. Tools for cement walk work are furnished by several manufacturers, for which reference may be made to our advertising columns. They cost from one to two dollars a set.

ARCHED SIDEWALK CONSTRUCTION.

Will the "Directory of American Cement Industries" give instruction on the construction of floors, roofs, bridges, etc., using cement concrete and steel or iron, also cement walks and steps? Which is preferable to support a vaulted walk, I-beams with corrugated arched sheet steel, arched wire netting with rods in it, or expanded metal at the bottom of the cement supported during construction by wood?

Geo. W. Clark,
Wausau, Wis.

The Directory gives full descriptions and specifications for the construction of Monier, Melan and Thacher arches, which are directly applicable to the other forms of steel used for similar work. Cement walks are also fully described. The construction of cement steps differs only in the necessity of making forms into which to tamp the material to the desired shape. For the ordinary sidewalk, I-beams placed say three feet apart with arches reinforced by any of the methods mentioned will be satisfactory. In general, that construction is the most durable in which the steel is completely imbedded in the concrete. If the walk or drive is subject to heavy weights or to shocks from heavy weights falling upon it, there must be special care to make the beams and arches strong enough to stand the extra strain. The usual thickness of walk, with the arched form given its lower surface, is sufficient for the ordinary sidewalk, seldom subject to anything but foot traffic.

BOOKS ON PARKS AND CEMETERIES.

Will you please name one or two books, or publications, from which I may get information pertaining to cemeteries and parks, especially the former?

M. A. Kirby, Florence, Ala.

Loudon's "Encyclopedia of Gardening" ($7.50), Parsons' "Landscape Gardening" ($3.50), are two books which will furnish valuable information. "Park and Cemetery" was published monthly at Chicago for some time, and devoted to the subjects denoted by its title. A copy has not been seen at this office for some time and it may be discontinued. MUNICIPAL ENGINEERING contains many hints on these subjects, more particularly on parks, and the back volumes have many illustrations of park plans and their results, which should furnish many valuable pointers.

BOOKS ON HYDRAULICS.

What book that treats on hydraulics shall I get to help me to solve problems on flow of sewage and the like?

Forest Talbott, Rodman,
Owensboro, Ky.

Merriman's "Hydraulics" ($4) is probably the most satisfactory book for your study of the principles of hydraulics. With sufficient knowledge to know how the tables are made and how and when to use them, such tables as those in Folwell's "Sewerage" will answer quickly most of the questions on rate and quantity of flow of sewage. Colby's Sewer Computer is a very satisfactory application of the slide rule to the same class of problems.

SEWER PIPE AND CONNECTIONS.

Which is the better material for sewer pipe, fire clay or shale, and which is the more lasting? Is it not a great injury to sewer pipe to break holes in it for connections?

M. J. Dill, Kane, Pa.

It seems to be the general opinion of those who have most experience in the use of sewer tile that the tile made of shale are more durable than those made of fire-clay, but the method of manufacture has something to do with the case, and a good fire-clay tile is better than a poor shale tile. Both should be salt glazed. The quality of the tile can not always be told from the color. Tile should never be cut for connections. If a connection is needed where the "Y" was not inserted when the sewer was first constructed, a joint of the pipe should be removed and a new joint with a "Y" should be inserted. This is the only way in which the sewer can be kept in its proper condition. No matter how well the work of cutting the hole for a connection is done, there is a chance for damage to the pipe and the sewer, which will certainly give trouble at some time, even if the work is well done at the beginning.

BOOKS ON ELECTRIC RAILROADS AND EQUIPMENT.

What are reliable works on construction and equipment of electric railroads?

Hiram Bruner,
LaPorte, Ind.

Our book lists have the following titles: Dawson's "Electric Railways and Tramways" ($12.50), on design, construction, equipment and working; "Bell's Power Distribution for Electric Railways" ($2.50), on laying out electric railway circuits; Crosby and Bell's "Electric Railway in Theory and Practice" ($2.50), a systematic

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treatise; Hanchett's "Electric Railway Motors" ($2); Houston and Kenelly's "Electric Street Railways" ($1), for beginners; Merrill's "Reference Book of Tables and Formulæ for Electric Street Railway Engineers" ($1); Perry's "Electric Railway Motors" ($1), elementary, intended for motormen; Prindle's "Electric Railway of Today," paper (50 cents); Trevert's "Electric Railway Engineering" ($2); see also page 22 of January number. MUNICIPAL ENGINEERING can supply any books desired.

BRICK PAVEMENT ON BRIDGE.

What is the usual practice in laying brick pavement on bridge or viaduct? Would plank base with 2-inch sand cushion be satisfactory?

John W. Hahn,
Boston, Mass.

A serious objection to the use of brick on a steel bridge or viaduct is the excessive weight, due to the thickness of the brick blocks and to the sand cushion. An arch bridge of sufficient strength to carry the brick pavement would supply foundation sufficient. A little computation would show the heavy weight of a sand cushion even one-half inch in thickness and this would be but a small part of the weight of the brick. Asphalt is used on steel bridges because it can be laid in a thin sheet, and wooden blocks because they are comparatively light. The ordinary sand cushion is omitted or reduced to the lightest possible. The bridge can be made strong enough to carry the brick pavement, but what is saved in cost of pavement is more than made up by increased cost of steel.

STANDARD BRICK SPECIFICATIONS.

Can you refer me to the "Brick Manufacturers' Standard Specifications for Paving Brick?" We wish to refer to them in making specifications for about four miles of brick streets.

L. B. Merriam, De Kalb, Ill.

The National Brick Makers' Association proposed standard specifications for brick tests in 1897, which were modified somewhat in 1899. These are discussed in articles in MUNICIPAL ENGINEERING of April, 1900. The Committee of the Association still has the question under advisement and expects to report this year. It should be noted that these are specifications for testing paving brick. The association has been very careful not to propose any specification by which brick shall be accepted or rejected on the results of these tests. This is left to the local engineers to determine in accordance with local requirements. Standard methods of constructing brick pavements were proposed at the last meeting of the association. These matters are given and discussed on pages 211, 219 and 232 of our last number (April, 1901).

Professor Talbot's proposed standard method of conducting the rattler test of paving brick is described on page 97 of the number for February, 1901. This method is under favorable consideration by the committee of the N. B. M. A. Until that committee reports it is well to say that the N. B. M. A. has no standard specification for testing paving brick. It never had, and probably never will have, a standard specification for paving brick.

PLATS OF RAILROAD PROPERTY.

Should railroads be required to file plats of their property in the city with the city engineer, showing distances from block corners on all streets that are crossed? What is the practice in cities?

J. F. Parr,
East St. Louis, Ill.

Many cities and towns require the filing of such plats. Those who do not must be satisfied with the descriptions and plats filed with the County Recorder of Deeds and Plats. It is hardly possible to demand greater accuracy of these plats than the city obtains in its own surveys. Theoretically the city block corners should be definitely marked and all descriptions of property should be referred to them, the same detail being required of railroads as of other persons platting city territory. Practically, the block corners are seldom marked except by buildings and curb lines, liable to removal at any time, so that even if required by ordinance to file the plats suggested, the railroad engineers can successfully delay filing of plats on the plea of indefinite city lines, which it is not their business to determine. Practice should conform as closely to theory as possible and agitation of such questions as this may be beneficial in bringing about greater accuracy in city records and markings.

INDIANA SPECIAL ASSESSMENT LAWS.

In the past few months you have given notice in your MUNICIPAL ENGINEERING of considerable paving which was to be contracted for in the State of Indiana. As it is the general belief of Chicago contractors, also of the attorneys who pass upon the validity of special assessments that the Barrett law is unconstitutional and that there might be great difficulty in receiving payment on bonds for any work which might be done under the Barrett law, I write to inquire if you are aware of any change which has been made or which will be made in the near future in the special assessment laws of Indiana.

James A. Sackley,
Chicago, Ill.

Most of the decisions bearing upon the constitutionality of the Barrett law have affirmed it. The principles of the law are

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discussed in a decision by the Indiana Supreme Court in the case of Thomas B. Adams against the city of Shelbyville, reported on page 399 of MUNICIPAL ENGINEERING for June, 1900, and the court holds that each provision of the law is fully sanctioned by the constitution of the state. The constitutionality of the law was again affirmed directly in the case of Annie E. Taylor against the city of Crawfordsville, reported on page 424 of MUNICIPAL ENGINEERING for December, 1900. Similar opinion is expressed regarding the general law in the decision upon the case of William Holt against the city of Indianapolis, in which the application of the Barrett-law system in the Indianapolis charter is upheld.

Decisions in state courts against the constitutionality of the law have all been in lower courts and were prior to these expressions by the supreme court.

In the United States Court the decision was adverse in the case of James Charles against the city of Marion, reported in page 55, January, 1900; page 259, April, 1900; and page 45, July, 1900, in its various stages.

These decisions indicate that the Barrett law is applicable to residents of Indiana, but non-residents owning property in the state have an opportunity to escape assessments if the Federal court adheres to its decision in the case quoted.

On page 238 of the April number will be found abstracts of two laws passed by the last legislature, one on street improvements in cities organized under the general law, taking the place of the Barrett law in such cities, and the other on notice to property owners before liens for street improvements can be enforced against property, which attempt to remove opportunities for doubt regarding the constitutionality of the methods of procedure.

CONCRETE STREET CROSSINGS AND STREET RAILWAY.

We have a contract for improving a street in which the specifications provide for laying street crossings of Portland cement concrete. A double-track electric railway has been laid. The contractor now objects to laying concrete crossings, claiming that the tremor caused by passage of the cars will crack the concrete before it can set.

The excavation was eighteen inches below top of rail; foundation, four inches of broken stone rolled with fifteen-ton roller and covered with four inches of gravel for bedding and tamping ties. Can the cement concrete crossings in and between the tracks, and on ties outside of tracks, be laid without damage from the tremor caused by the passage of electric cars once every half hour?

L. W. Mathewson,
Cincinnati, O.

With an 8-inch foundation under the rails as described the tremor from the passage of the street cars should be slight. It would undoubtedly be advisable to run the cars over the crossings very slowly for a few days until the cement has thoroughly set, as a precaution easy to take. Repairs to the portion of the walk between rails and track will be required more frequently than elsewhere, on account of the isolated blocks and the vibration of the road-bed, without reference to the time of setting which the cement requires, which will tend to separate the concrete blocks from the foundation, especially where ties make the depth slight. This will render the blocks more liable to being moved or broken by wagons passing over them.

MUNICIPAL MATTERS IN COURT.

Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.

Power to Narrow Streets.—A Texas statute conferring on the city council exclusive control over public streets and giving the power to alter, widen and extend the same, is held to give authority to curtail the width of a street. Scott et al. v. City of Marlin et al., 60 S. W. Rep. 969.

Obstruction of Streets.—A city has no right to erect and maintain a water tank or other permanent structure on a street which does not aid public travel, and which injuriously affects the beneficial enjoyment of the premises of an abutter, or his means of ingress or egress. Davis v. City of Appleton, 85 N. W. Rep. (Wis.) 515.

Specifications for Curb and Gutter.—A city ordinance authorizing the laying of a combined curb and gutter, with a center foundation six inches in depth, the curb to be six inches in thickness throughout, and the gutter-flags to be eighteen inches in width, the top of the curb to be at the established grade of the street, was insufficient to authorize a judgment confirming a special assessment, since it does not specify the height of the combined curb and gutter. Willis v. City of Chicago, 59 N. E. Rep. (Ill.) 543.

Permission to Lot-Owners to Improve Street.—Under the charter of the city of

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Louisville, providing that "the general council may, in its discretion, upon a petition of a majority of the property owners on the part of a public way proposed to be improved, grant them permission to improve said public way, under the supervision of the engineer," a petition signed by an agent for property owners, which was granted by the council was sufficient to protect the property owners in the construction made thereunder, so as to exempt them from further taxation for that purpose. Though the charter required an ordinance for the construction of the street, yet, as the council by resolution, accepted the proposition of the lot owners, and permitted them to incur the expense of the work under the belief that they would be free from further taxation for the purpose, the city can not now charge the property owners with any part of the cost of reconstructing the street, upon the idea that the construction is an original one. Gleason v. Barnett et al., 61 S. W. Rep. (Ky.) 20.

Itemized Statement of Costs of Improvement.—A statute required a bill of costs of public improvement, showing in separate items the cost of grading, materials, laying down, and supervision, to be filed in the office of the clerk, and certified to by the officer or board designated to take charge of the improvement, together with a list of lands touching on the line of the improvement, names of the owners, etc. *Held*, that a notice to an abutter, filed with the clerk, signed by three persons designating themselves "Committee of Streets and Alleys," notifying him that his land, described as a forty-acre tract, one part of which was contiguous to an improvement, was taxed, etc., and that the total amount was a certain sum as per items annexed thereto, and attached to which was a column of figures footing up the sum stated to be due, but not showing what the items were, and not certified to, was not a compliance with the statute. Holland v. People, ex rel. Miller, County Collector, 59 N. E. Rep. (Ill.) 753.

Overhead Wires—Removal.—A Baltimore city ordinance authorizing telephone companies to lay wires in underground conduits, and to make necessary house connections, in such manner as may be best adapted to location, by means of wires from the cables laid, provides that the companies shall construct at least three miles of conduits within two years from the passage of the ordinance, and after said two years, and as rapidly as said conduits may be constructed and cables laid therein, all poles on any street along which such conduit is constructed and cable laid, shall be removed, and shall not be replaced, except in so far as such poles are necessary for the purpose of making distribution of wires forming part of any cable. *Held*, that the companies are not required to construct underground conduits in every street along which they desire to furnish telephone service, but they must remove all poles where a conduit is constructed and cable laid, except such poles as are necessary for distribution. Mayor, etc., of City of Baltimore, et al. v. Chesapeake & P. Tel. Co. et al., 48 At. Rep. (Md.) 465.

Municipalities and Trades Unions.—The records of the city council of Paterson, N. J., show the following entry: "Resolution by Alderman T. C. Wright, that this board place itself on record as desiring to favor anything calculated to benefit the working people of this city, and desires to express its sympathy for those who are endeavoring to better their condition: Resolved, that in furtherance of this idea we think that it should be the sense of the city government in every way possible to patronize such establishments as recognize trade unions and pay union wages to their employes. Resolved, that in pursuance of such principle, that the printing and stationery committee of this board and the officers of this city be, and they are hereby directed to confine all orders for printing and advertising, so far as it can be legally done, to such offices and newspapers that recognize the typographical union, and that the finance committee and city comptroller audit no bills for printing done in other than union printing offices." The supreme court of New Jersey has just rendered an opinion declaring the resolution void as tending to monopoly, and the imposition of additional burdens upon taxpayers. State (Paterson Chronicle Co., Prosecutor) v. Mayor, etc., of City of Paterson, 48 At. Rep. (N. J.) 589.

New York Labor Law.—The labor law (Laws 1897, c. 415, as amended by Laws 1899, cc. 192, 567) provides that laborers on public work shall be paid the prevailing rate of wages; that contracts for such work shall stipulate that they shall be void unless complying with the act; and that the contractor shall not be entitled to receive any sum, and no public officer shall pay the same for work done on a contract which in form or manner of performance violates the statutory requisites of such contracts. Section 3 provides that public officers violating the act shall be guilty of malfeasance, and that any citizen may maintain proceedings

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to suspend him, or to avoid or cancel contracts violating the act, or to restrain payment on such contracts. *Held*, that the act is unconstitutional, since it takes away the liberty of freely contracting, both from municipalities and those contracting therewith. The act contravenes the provision of the constitution that no person shall be deprived of his property without due process of law. The legislature of a state has no right to interfere, and control by compulsory legislation the action of municipal corporations with respect to property, and contract rights of purely local concern. People, ex rel. Rodgers, v. Coler, City Comptroller, 59 N. E. Rep. (N. Y.) 716.

Powers of Street Superintendent.—Finlayson, St. Laws, p. 9, § 3, requires the city council, before contracting for sewer improvements, to pass and publish a resolution of intention "describing the work" proposed, and provides that the city engineer shall make plans and specifications and estimates of the cost thereof, which, by Id., p. 42, § 5, become part of the contract to be awarded when approved by the council. Id., p. 61, § 6, provides that the work must be done under the direction and to the satisfaction of the superintendent of streets. The ordinance of intention for the work required it to be done in accordance with plans and specifications on file in the city clerk's office, one of which provided that "when the ground does not afford a sufficiently solid foundation, the contractor shall excavate the trench to such increased depth as the street superintendent may decide to be necessary, and shall then bring it up to the required level and form with such material and in such manner as the street superintendent may direct." *Held*, that an assessment levied for work done under a contract based on such plans and specifications was not invalid on the ground that such specifications delegated to the street superintendent powers of the council. Haughawout v. Hubbard et al., 63 Pac. Rep. (Cal.) 1078.

THE COST OF INSTALLING A WATER METER SYSTEM.*

By A. L. Holmes, Grand Rapids, Mich.

In considering the question of the sale of water by the company or municipality to its consumers for domestic as well as for power purposes and mechanical uses, the question has been pretty well settled that we must know the amount taken by each consumer if we are to ask each to pay a fair price for the amount delivered.

We know to a reasonable certainty the amount of water furnished for all purposes by the pumping plants of the city and the total cost of operating them, and we get in this manner the cost of delivering a thousand gallons or a thousand cubic feet, as we may choose to reckon it; and it is the most reasonable way to sell this water in a manner that will return to the producer a just price for the product, and at the same time do no injustice to the consumer.

Only one means has been formulated to accomplish this result, although for hundreds of years various expedients have been resorted to to avoid this just way of doing business.

There has been enough evidence furnished and enough written and reported by the best and most experienced men in this line to convince all of the equity of the meter system.

What water meters have done for many of the departments, they will do for any of the others. They will reduce waste, increase pressure, increase revenues, settle disputes and satisfy the buyer and seller that this is the only equitable way to handle the water business.

Superintendent of Water Works J. B. Hein of Madison, Wis., has said:

"By the use of meters our saving in waste is 43 per cent., and our saving in fuel is 64 per cent."

The city of Ottawa, Ill., in the year 1897 decided to sell water only through a meter, and in consequence purchased 631 meters and placed them in service at once.

These meters cost them	$8,053 90
Placing them cost	1,204 26
A total cost of	$9,258 16
Or an average of each meter	14 76

Perhaps it will not be out of place to give the results of this business transaction as stated by the superintendent of water works. He says:

"As the main object in placing meters on all services was to preserve the artesian water supply and to prevent useless and careless waste, the operation shows that meters have saved of the water 39 per cent., and have decreased the pumping expenses 63 per cent.

"This insures an ample supply of artesian water for years to come, and also gives

*A paper read before the meeting of the Michigan Engineers' Society, 1901.

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consumers privileges in the use of water which could never be given under a flat or schedule rate."

In considering the cost of installing a meter system we are faced with the problem of who shall pay for the meter. The consumers of water from a public system must pay for the operation of the plant, for keeping it in repair, and for the interest on the outstanding bonds. If one-half of the product is wasted, this must be paid for by the customers and increases the cost of the product used. The more coal burned, the more must be charged to the maintenance account, and the more bills must the water consumer pay.

In practice, water plants must be operated and sustained by the money received from the water takers, and the meters are a part of a plant, the scales as it were, the expense attending them must be borne by those who use the water.

I find that generally people are better satisfied where the water department purchases, installs and keeps the meters in repair, and is recompensed for the outlay from the water rates, than where the consumers are required to advance the price of the meter and its setting in full.

If we could start a new plant and meter all the services as fast as put in our troubles would be less acute; but as the works are nearly all built, we must take things as we find them and do the best that we can to remedy the evils that for generations have been accumulating.

The selection of the kind and make of the meter should receive a good deal of consideration from the superintendent and should be controlled by him.

Some things besides the name meter are requisite in this machine and if paid for by the consumer he generally procures it from the local plumber, who furnishes the cheapest machine at the highest price of a good meter, and it will probably be a source of dissatisfaction to all concerned, and add much to the cost of maintenance.

The meter must be simple in design, and durable in construction, of material not easily affected by the water in which it must work. It should be so easy to read and compute that any consumer can keep tab on the consumption and test and ascertain if there are leaks on the premises. A meter that is often in the repair shop is very undesirable. Accuracy is necessary, for if the meter is not a close registering machine it will not catch the small flow and consequently may allow leaks to continue without discovery and thus defeat one of the main objects of using the meter.

There are many meters on the market, and some of them are snares and delusions to catch the unwary and unsophisticated water works superintendent, and may disgust him with their unreliability and lack of durability.

Like any other water works machinery or appliances, the best is none too good.

In the cost of maintenance it is certain that the best designed and constructed machine will cost the least for repairs, and consequently the first cost, within reasonable limits, may not cut much of a figure.

The actual experience of cities that have used meters for years will perhaps be the best testimony that can be obtained to show the kind of meter to be used by the city commencing this system.

The first services generally metered are the factories, hotels, restaurants, saloons, livery stables and public buildings; then those residences where lawns are sprinkled, as well as metering street sprinkling carts, and then the placing of a meter on all other users of water.

Perhaps the principal reason for this plan of metering lies in the fact that the larger pipes used by the first class of services waste more water than the residence does; but experience shows that there is about as much waste in many households as in the larger services.

As a general proposition, however, the employes of the factories and larger consumers have but little interest in stopping the waste and leaky services in unmetered premises, and it is only when the employer, who has to pay for this wasted water when metered, gets after this matter that the leaks are looked after and the waste checked.

In the setting of meters the custom is quite general to place the larger ones measuring the use of factories, etc., outside of the metered premises near the curb line and in a vault or box of brick, concrete or wood. These boxes, if built of brick or concrete, are generally, in this climate, as deep as the service pipes and large enough at the bottom to allow of detaching the meter for repairs or changing it, and with a suitable iron cover will cost about seven dollars each, including the cost of setting the meter. If a wooden box is used the expense will be about four dollars each.

There have been several meter boxes put on the market in the last two years, made of iron or tile, facilitating the placing the meters outside of the metered premises, at the curb line, and at a point where they are always accessible by the water department and free from interference by others.

There are, undoubtedly, good reasons for the location of the meter near the curb cock whenever practicable, but it adds somewhat to the cost of installation.

I have investigated several of these meter boxes, some with patented devices, and find them generally well designed and well made of durable materials and adapted to a permanent and economical setting of meters.

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The cost of installation with them is less than with boxes built of brick or concrete and but little more than where the meter is set in wooden boxes.

In some forms of these boxes the meter is in a water-excluding and an air-tight box that is clean and dry and at all times accessible to the person and with no liability of interference by others.

It facilitates the reading of meters, and its difference, if any, in the cost of construction will be more than offset by the insuring of the care of all leaks in the service after it leaves the curb cock.

In this Michigan climate, it will cost to set a meter in one of these boxes at the curb line, about six dollars; while in that section along and south of the 40th degree of latitude, the cost would be about five dollars each. Whichever plan is adopted, it is best that the meter be so placed that it can be read easily, and can be removed without any digging or delay.

The meter must be protected from frost and be secured from the introduction of ground water and surface water, for unless this is so, the reading of the meters will be slow and expensive.

As the cost of maintenance is much increased if the setting of the meter is poorly done, or if it is so located as to receive injury from frost or mud, I should advocate the best location and the best material and work in all cases. In fact, it does not pay to use any poor material in the construction of any part of a water works plant; for we are building for the coming generation, and perhaps centuries, and permanent work and material only should be allowed.

When the meter is placed in the cellar of a residence or in the basement of a store or factory building, it must be protected from freezing by placing it in a pit below the bottom of the cellar or by boxing, or covering with sawdust or some other material that will protect it. In the most of these cases, the cost of setting will be about one and one-half dollars each.

At Battle Creek, where the inside setting is done in brick manholes, the cost of setting is about three dollars each.

In the reading of meters, if a general system is in use, a good deal of variation exists between the different plants. Where they are set outside the building at the curb line, about double the number can be read and inspected than if they are set in cellars and in basements. Probably about one hundred per day in the latter case will be the average.

At Lexington, Ky., where all the meters are set outside at the curb line, the superintendent reports the reading of three hundred to four hundred daily, and this is quite an argument for placing the meter outside the premises supplied with water; but in our northern climate in the winter, when ice and snow must be removed from the cover of the box, the outside setting could not be handled as rapidly as in a region where this does not bother, and I think this should be estimated at about one hundred per man daily. The readings, if made monthly and the bills rendered, will be found much easier to collect on acount of the smaller amount of each payment, and where quarterly or semi-annual bills are rendered.

I should estimate the monthly reading of meters to cost 18 cents yearly, allowing one hundred to be the daily reading. The gas companies do this work for considerably less. The office work will not be materially increased in a metered plant. With proper books for recording and numbering and a system of close collections, the work will require no more help than where collections are made on the assessment plan, with its rebates and wrangles over the use and abuse of fixtures, and the less inspection required in the metered plant will reduce rather than increase the office expenses.

In the matter of repairs, a search of the records of many plants that have used meters from ten to fifteen years, shows that about 2 per cent. per year of the cost of the meter is a fair price for depreciation.

Very few of the reports of the cities make as plain as I would like this item of expense; but by personal observation and correspondence I conclude that this is about the right figure. Of course, in cases where carelessness in the setting of meters has caused damage by frost this percentage might be increased. If a good meter is purchased the repairs on it will be less than 1 per cent. for the first five years.

The principal parts requiring repairs in meters of the Worthington type are the pistons, bushings and gearing.

In the disc type, broken discs and worn out intermediate gears furnish the bulk of repairs.

In the rotary and oscillating type the intermediate is the main part to wear.

The cases of gun metal are practically indestructible, and the renewal of the other parts each ten years would keep the cost of repairs less than the figures I make.

Of course there are goods on the market of inferior design and poor material whose life will be ended and they consigned to the melting pot in less than five years. But it does not pay to buy a poor meter or do cheap work in its setting or to be careless about its handling; and as a general proposition the more care taken in its construction and the better material in the meter the longer its life and the less the cost of its repairs.

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And when we have purchased a good meter it is well that we put a little more money in its installation and protect it from injury from frost and dirt, remembering always that eternal vigilance is the price of good water and an efficient water works system.

Taking an average Michigan town with one thousand services in use, the cost for meters for the plant and their settings will be about as follows:

Cost of 1,000 meters (all sizes).....	$11,680 00
Cost of setting 16 outside at $7 each	112 00
Cost of setting 984 inside at $2 each	1,968 00
Total cost of 1,000 meters set ..	$13,760 00
Interest on $13,760 at 4 per cent.....	$550 40
Depreciation and repairs at 2 per cent.....	275 20
Total extra yearly cost of meter system	$825 60

Against the other side of this account the saving in fuel alone in a plant of this size will amount to as much as the cost above, and the saving in one-half of the water supply is also worth more than the cost of the meter system.

The time generally taken to meter a plant is about two years, although some towns do it in a year, and some towns take five years. As the best water works authorities have agreed that very soon all water shall be sold through meters, it behooves us all to urge the change of the system of selling water to the meter at once. Hartford City, Indiana, changed its system from the schedule rates to a complete meter system in one year, setting all meters outside in air-tight boxes at the curb line, using five hundred disc meters, at a total cost of about $5,500, including setting. Briefly I will give the results of this transaction:

In 1898 there was 488 taps unmetered, pumping 73,687,475 gallons; in 1899 there were 544 taps partly metered, pumping 64,772,225 gallons; in 1900 there were 605 taps, all metered, pumping 54,767,950 gallons; in 1898 the average pumped per tap daily was 414 gallons; in 1899 the average pumped per tap daily was 326 gallons; in 1900 the average pumped per tap daily was 248 gallons; in 1898 the average revenue per tap daily was $5.74; in 1899 the average revenue per tap daily was $6.25; in 1900 the average revenue per tap daily was $8.51; in 1898 the total revenue was $2,800; in 1899 the total revenue was $3,400; in 1900 the total revenue was $5,147.95.

Decatur, Ind., completely metered the plant with four hundred meters for $4,000, or an average of $10 each, mostly set at the curb line.

The entire cost of metering a water works plant is less than a new pumping outfit will cost, and the wasted water will be saved to supply as many more consumers as the town now has.

And this water we must save and keep, for pure water is getting difficult to find and is going deeper in the ground, and its securing in sufficient quantities is attended with large expense, and it seems as though any men, or set of men, who are competent to handle the $100,000 or more invested in a water works plant, would at once adopt some system by which they could stop the waste and secure the cost of their product.

The cost of the installation of a meter system, while it seems large, is but a small sum when compared to the cost of the wasted water computed for ten years, and unlike most of the municipal debts, that is paid for by the machines themselves.

A HISTORICAL SKETCH OF SLAG CEMENT.*

By Prof. William Kendrick Hatt, Purdue University, Lafayette, Ind.

By Prof. William Kendrick Hatt, Purdue university, Lafayette, Ind.

The following paper gives an elementary statement of the nature and properties of slag cements:

A statement in general of the processes involved in the manufacture of cement from slag material or from limestone and clay material, will make clear the discussion which follows.

A Portland cement, commonly so-called, is made from either pair of the following raw materials artifically mixed together in a finely divided form:

Compact limestone with from 18 to 20 per cent. of clay.

Chalk and clay.

Marl and clay.

Clay-bearing limestone properly dosed with clay or shale, or limestone. This mixture is calcined at a high temperature to nearly the point of fusion. The resultant clinker is ground to a fine powder, and in this condition called Portland cement.

A "slag cement," commonly so-called, is made from the cinder or slag which results when a mixture of limestone and iron ore is burned in the blast furnace. The iron ore

*From a paper presented before the Indiana Society of Engineers.

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contains the silica and alumina, which are found in the clay element of the mixture used in making Portland cement. This slag is suddenly cooled, dried and mixed with about one-fourth part of slaked lime, and then the mixture finely ground to form the cement.

Two plants in the United States make cement from slag material by a process similar to that of Portland cement manufacture, that is, the mixture of slag and limestone is calcined to a clinker. One of these, in Pittsburg, uses the granulated slag, mixed with compact limestone; this mixture is finely ground, then calcined in a kiln to a clinker, and ground again just as in the case of Portland cement.—(The other plant, in Chicago, uses a similar process.—Ed.)

For works requiring an early and final strength, Portland cement is usually specified by the engineer. The attempt to use under such specifications certain cements, called Portland cements, but made from a mixture of slag sand and slaked lime, has led to a dispute. On one side we find ranged those who claim that an essential feature of production of a Portland cement is a calcination, or roasting of a certain artificial mixture of carbonated lime and clay to a clinker, and subsequent grinding to a powder. On the other side we find those who insist that the burning to a cinder of the limestone and other material of the blast furnace furnishes a material which, chemically, is nearly a proper mixture for a Portland cement, and that the subsequent correction by addition of a slaked lime paste does not, from the point of view of a definition, involve an error in the case of those who call this product Portland cement.

There are two ways of regarding the dispute. First, from the point of view of a descriptive term it is well to have a separate name for two products which are different in their mechanical and chemical properties. If we desire a sidewalk cement, we should not specify the material by any name which will involve a cement made by the second process above described for slag material, involving no calcination. Nor should we shut out a product like the Pittsburg product, or a similar product made in Chicago.

Second. From the point of view of historic origin it has been pointed out that the original patent for Portland cement involved a double calcination; first of the limestone; then of the mixture of this calcined limestone and clay. So strictly speaking our modern Portland cements have no right to succession to the term Portland.

The cements made by the first process have, however, the right of possession to this term Portland. It would then seem the part of wisdom to divide the cements of this country into three classes—natural, Portland and slag.

Natural will include those made by roasting and subsequent grinding of an argillaceous limestone (a natural mixture of limestone and clay).

Portland will include those made by calcining to a clinker and then grinding an artificial mixture of the proper proportion of limestone (or marl or chalk, or clay-bearing limestone) and clay (or slag sand). The slag cements will include those made by grinding a mixture of pulverized granulated slag and slaked lime paste, which mixture has been made without applied heat.

In the paper below this understanding of the term "slag cement" is intended.

This matter is somewhat important as at least four brands of slag cements as described above are on the market as Portland cements. To ask for a definite classification is not to find fault with slag cements. They have a distinct and high value for many engineering works. Let engineers write the specifications and manufacturers put out their product on the same nomenclature.

The definition of Portland cement above referred to is in conformity with the specifications of the German association of cement manufacturers, the French Ponts et Chaussees, Swiss government, Austrian engineers and architects' association, Russian minister of roads and railways, and recent specifications of the United States engineers.

MM. Bruil and H. Henry, in a communication to the Congress for Unification of Tests of Materials before the Paris exposition, July, 1900, have given information concerning the development of the manufacture of slag cement, from which communication the following facts are mainly derived:

In 1898 thirty-six million tons of slag were produced in connection with the manufacture of iron. Many futile attempts have been made to use that by-product. Successful use has been instanced in railway ballast, molded blocks for engineering structures, such as sea walls and embankments, and mineral wool.

In 1737 Belidor in his Architecture Hydraulique had noted that a mortar could be made of pieces of hard brick, splinters of rock and ground blast furnace slag mixed with fresh slaked lime. At the beginning of the century Vicat had noted that certain slags had the properties of pozzuolana (pozzuolana is a volcanic lava which, when mixed with hydraulic lime, forms an hydraulic cement. "Puzzolan" is an imported slag cement used extensively in St. Louis.)

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The utilization of slag, however, was not attended with great importance until in 1861 Langen, a founder near Troisdorf on the Rhine, discovered that the slag could be granulated by sudden cooling. Instead of the solid mass of cooled slag, a slag sand could be produced. The effect of this granulation on the pozzuolanic properties of the slag was soon noted. In 1862 at Osnabruck the application of this granulated slag to the manufacture of cement was attempted and the subsequent use of this slag included chiefly the formation of bricks and molded stones by a mixture of this slag sand and slaked lime, a process which has extended itself to many countries.

About 1880 the process of making slag cements on a commercial scale by a cold mixture of granulated slag and slaked lime was inaugurated in the canton of Berne, Switzerland. About the same time certain manufacturers of Portland cements in Germany began to mix a ground slag sand with their product with the result of increasing its strength. It is said that such mixture up to 2 per cent. is not harmful and is practiced at the present day. The sophistications became so general in Germany and England that protests were made against the practice, adulterations of 30 per cent. having been found. The manufacture of slag cement spread rapidly, and at one time there were nine mills in France and twelve in Germany. At the present time, according to MM. Brull and Henry, there are the following mills in operation:

Country.	No. works.	Production (tonnes of 2,204.6 lbs.)
France	10	85,000
Belgium	5	.....
Luxemburg	2	.....
Switzerland	1	.....
Germany	12	180,000
Austria-Hungary	3	100,000
Spain	1	.....
Russia	1	.....
England	2	.....
United States	4	.....

These statistics do not include mills which roast the product in a kiln. Certain mills in Germany and two in the United States have lately transformed or built mills to manufacture this roasted product.

While these statistics are given in the paper of MM. Brull and Henry, it is to be noted that in a consular report to the state department, dated 1895, the statement is made that the slag cement mills are gradually closing down, there being but one mill in Germany, one in Belgium and three in France. This report conflicts with the statement of the paper of MM. Brull and Henry, quoted, and with the account in that paper of the universal and successful use of large amounts of the product in France.

In the United States there are in the author's knowledge nine plants making cement from slag materials, two of these employing a roasting process.

In France (paper of MM. Brull and Henry) the use of slag cement is admitted for bridges and roads, railroads, mines, municipal service. It is allowed by the Administration of Roads and Bridges in hydraulic works; was used in dry dock at Boulogne; used in Metropolitan railroad of Paris; is used in important bridges and tunnels.

A mixture of slag cement and granulated slag is made into bricks, moulded stones, tile pipes. It is said that 60 parts of lime are used by volume with 250-300 parts of slag sand to form the bricks. The pipes withstand a pressure of 71 lbs. per sq. in. and are used in sewers. Pipes are made of a stiff mortar of silicious sand and slag cement.

This cement is not recommended by the manufacturers in this country for such work as sidewalk work, where it is subjected to the influence of the atmosphere when spread out in thin sheets, but it is recommended for foundations, whether for streets, bridges, buildings, etc.

This paper does not pretend to give a detailed account of the process of manufacture. Briefly described the process is as follows:

1. Granulating the slag.
2. Drying the slag.
3. Mixing with desired per cent. of slaked lime.
4. Grinding mixture to powder.

In some cases the slag is ground before being mixed with the slaked lime.

The stream of slag may be run into water, or a stream of water may be brought into contact with the slag as near the outlet as possible; or the slag may be run from the furnace to a trough where a stream of water is flowing. The result is sand, like broken pumice stone, or thin shell pieces of pinkish color, containing 30 per cent of water, or more.

Drying the slag sand is accomplished in a rotary cylinder with inclined axis heated by an interior or exterior flame, or by spreading the sand on sheet iron dryers which are slowly passed through a heating chamber; or else in a vertical chamber with inclined runways of reversed grade, down which the slag runs and is dried.

The limestone is slaked in the mill and mixed with slag in a ball mill.

The materials are ground to an impalpable powder by the ordinary methods of cement manufacture.

The appearance of the slag cement is characterized by a delicate lilac color, in some cases almost white. When cement is

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made from slag by a process involving roasting, the cement is of a dark color like that of ordinary dark colored Portland.

It has not the coarse or gritty feeling which characterizes most Portland cement. It works fast, sets slowly and passes ordinary tests for permanence of volume.

A part of the cement exposed to the air has to be well covered to prevent the surface from cracking. After drying out it will exhibit discolorations, yellowish or brown, whereas the part hardened under water will not exhibit such discolorations. The characteristic color of the fracture of a water-hardened briquette is green, but when the briquette dries out the fracture becomes white. The writer has noticed this green color, with a subsequent change to white, in the case of a well-known American Portland cement, and also the discolorations in the pat, indicating slag adulteration, or else a not sufficiently oxidizing flame in the kiln. The green color is due to the presence in slag cement of sulphide of iron, This sulphide becomes oxidized on exposure to the air and changes color. Slag cements contain usually from 0.5 to 1.5 per cent. of sulphides.

It is this tendency to oxidation on exposure to the air, which is destructive to mortar made of slag cements containing an excess of sulphides, and makes it necessary to use the product in underground situations or the interior of thick walls. A parallel test of briquettes hardened in air and water should be made to check up presence of sulphides. This disintegration does not occur in case of all slag cements; it is not a necessary defect.

COST OF EARTH ROADS.*

By Prof. Ira O. Baker. Champaign, Ill.

To determine the amount of money spent upon earth roads, the writer sent a circular to each township in Champaign county asking for certain details as to the receipts and expenditures for road purposes during the year of 1900.

Champaign county is twenty-eight miles east and west by thirty-six miles north and south, and contains almost exactly 1,000 square miles. It lies in the corn belt, and is prairie, broken only by narrow strips of timber along four small streams or "rivers" three of which rise in the county. Most of the land originally timbered is now in cultivation. Farm lands without buildings sell for $80 to $100 per acre. The county contains 153 miles of railroads, or one mile of railroad for each six and two-thirds square miles of area. The population is 47,000, of which 15,000 are in the adjoining cities of Champaign and Urbana.

In Champaign county there is 1.97 miles of public rural highway for each square mile of area. This includes neither streets or roads within incorporated cities or villages, which must be cared for by the incorporation, nor the area of municipalities.

In Illinois three forms of road taxes may be levied, viz, a poll tax payable in labor or cash, a district road tax payable in labor or cash, and a road and bridge tax payable in cash. In computing the poll tax a day's labor of a man is considered to be $1.25, and of a team and wagon or plow $1.50. A team, wagon and driver are then, in law, equivalent to $2.75 per day.

Townships assess a poll tax varying from $1.00 to $2.00 per individual.

There are twenty-eight townships in Champaign county and one-half of them levy a district road tax which in every case is uniform over the township. The levy varied from 10 cents to 50 cents per $100 of the assesed valuation, the average being 25 cents. Nearly all of this tax is paid in labor, only a few non-resident land-owners paying cash. For the townships levying this tax, the average is $8.44 per mile, the range being from $3.51 to $13.39. This tax and the poll tax are usually paid in labor, and, therefore, in half of the townships the total labor tax is $2.49 plus $8.44 equals $10.93 per mile, while in the other half it is $2.49.

For the townships reporting, the average levy of the road and bridge tax was 56 cents per $100 of the assessed valuation, the range being from 25 cents to $1. The average taxes per mile are $23.93, the range being from $11.70 to $34.70.

The total labor and cash is $33.30 per mile, the range being from $16.60 to $52.70. In other words, Champaign county is spending on its country roads in labor and cash an average of $33.23 per mile, the range for the different townships being from $16.60 to $52.70. An attempt will now be made to show what is done with the money.

The townships reporting spent money for new iron bridges, equivalent to $16.20 for each mile of road in the township, the range being from $6.30 to $37.40. The county pays half of the total cost of large bridges, but the above cost of bridges does not include the amount paid by the county.

It seems probable that Champaign is spending more money for bridges than most other parts of the state. Drainage costs

*From a paper before the Illinois Society of Engineers.

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$6.32 per mile. Part of this expense was for outlets through dredged ditches, and the most, if not all, of the remainder was for tile drains. Three-quarters of the townships spent money for tile culverts, the average being equivalent to $1.32 per mile of road. All of the townships reported money spent for repairs of bridges and culverts, the average being equivalent to $2.93 per mile of road. Eighty per cent. of the townships reported expenditures for grading (not simply smoothing and leveling), the average being equivalent to $1.43 per mile of road in the township. All report expenses for smoothing or leveling roads (not grading), the average per mile of road in the township being $2.83. The range in this item is very great, being from 40 cents to $10 per mile. Three-quarters of the townships reported cost of mowing roadsides, the average being $1.14 per mile. The total of the preceding expenses is $32.17 per mile of road, or $64 per square mile, or 10 cents per acre.

The average expense is less than the total tax received, since the latter includes expense of administration. Unfortunately no inquiry was made as to the cost of administration and consequently no data can be given.

The expenditures for new iron bridges, tile culverts and drainage amounted to $23.84 per mile, or nearly three-quarters of the total expense, and are for permanent improvements. This work was almost certainly done by contract. If grading be considered a permanent improvement, then $25.27 per mile was spent for betterments. Repairs of bridges and culverts, smoothing the roads and mowing the roadside must be regarded as expenses of maintenance, the total of these items being $6.90 per mile. The writer has a few reports from other townships in other counties in the corn belt, and apparently Champaign county is representative, except that where there is gravel within easy reach they are spending considerable sums to construct gravel roads, in addition to expenditures substantially, as in Champaign county.

In conclusion, a few points deserve brief mention:

(1) Almost three-fourths of the expenditures were certainly done by contract, and, therefore, the criticism frequently urged against the labor system does not apply to this part of the road expenses.

(2.) At present the expenditure for maintenance proper is so small as to make it impracticable to delegate this work to one or more who shall give their whole time to the work. Without some division of labor it is highly improbable that our roads will reach a very high state of maintenance.

(3.) The expenditures for permanent improvements are needed for present conditions, and would be absolutely necessary before hard roads could be introduced.

(4.) Until farmers are willing to tax themselves more than $32 per annum per mile for earth roads, it is needless to expect them to willingly pay for hard roads. Farther, until farmers wear more expensive clothing and live in finer homes, it is unreasonable to expect them to willingly support the most luxurious highways.

ELECTROLYSIS OF WATER AND GAS PIPES.*

By W. W. Brigden, Eng'r and Supt. Water Works, Battle Creek, Mich.

The electric current is made or generated at the power house; it then passes overhead along the feed wires, which connect with the trolley wire, thence along the trolley wire to the car, down the trolley pole, through wires connected therewith to the motors, where considerable electro-motive force or power in the current is expended in propelling the car. The current then passes through further wiring and metal portions of the cars to the wheels and from the wheels to the rails. The amount or volume of current is still the same; that is, there is the same number of amperes, but the pressure or voltage is greatly reduced by the motors. The current then follows the rails to the point nearest the power house and is carried on wires from the rails to the other side of the dynamo from which it started.

In the double trolley system the same process takes place except that there is another trolley pole and another trolley wire alongside of the one which carries the current outward from the power house, and this second trolley wire takes the current back to the generator or dynamo. In the case of the double trolley the current does not get upon the rails or into the ground, water pipes, gas pipes, etc., but is returned to the power house by wires suspended in the air, as is the case with electric light and other similar wires. The process of electrolysis is often quite similar to that of electroplating, although the path of the electric current is not so well arranged for doing the work in the case of the street railway current as is that of the electroplating machine. The current in the case of the street railway is only

*Read before the Michigan Engineering Society.

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able to carry the material subjected to electrolysis a short distance away from its source, but is frequently powerful enough to make a heavy deposit on stones, sand and other similar materials at a distance of from one to three inches from the pipe.

Our own home story is always the easiest one to tell, and while it is not nearly so interesting as that of many other places, still it has some points of peculiar interest that may not have come to the attention of any of those present. The city of Battle Creek was one of the first small cities in Michigan to grant a franchise to an electric street railway company. They granted a gentleman a franchise, who shipped in a lot of second-hand flat rails from Cleveland, O., and the balance of his material for construction was very little better. The rails were bonded with iron telegraph wires about one-eighth of an inch in diameter. The trolley wire was small and the cars did not begin to compare with those of today. The original management operated the road for a year or two and then sold out to another party. By the statement of its own employes the company was losing fully one-third of its current in forcing it over the miserable conductors it used. All the wrought iron and lead gas and water pipes in and near the power house were completely destroyed, and the eight-inch water main received considerable injury. The writer has failed to learn of more than one street railway as poorly constructed as this one.

The present street railway line was constructed by a much better class of men, and while they did not provide for the taking care of their electric currents so well as is done at the present day, the construction was fairly good for the year of 1895. Sixty pound tee rails were used and most of the rails were bonded with two No. 0 copper wires at each joint. Experience with the old company led the officers to be on the lookout for damage from electrolysis, and when there was a leak in the water service about five hundred feet from the power house the superintendent made an examination and determined that it was occasioned by electrolysis. There was afterwards a large leak under the floor of the power house. The water from this leak did not pass through the meter upon the premises, but as it was a clear case of electrolysis, a bill was sent to the electric light company, who furnished the railway power, for the estimated amount of water wasted, and the bill was paid. The four-inch water main on the street near the power house was so much injured in about four years that it could be cut in many places to the depth of one-sixteenth of an inch.

Many cities have employed expert electricians to make examinations of the damage that may have occurred from the return currents of the electric railways, and almost without exception some damage has been discovered to water pipes, gas pipes, lead conduits or other similar metallic substances. Battle Creek employed Mr. E. E. Brownell of Dayton, O. He reported much less damage than in other places, but that there were differences in electrical pressure between the water pipes and gas pipes on one hand and the rails on the other hand that would bring about the destruction of the service pipes, water mains and gas pipes within a very few years. The gas company joined with the city in having the electrical examination made and will also assist in any legal proceedings that may be undertaken. No electrical readings were taken at the original examination as to the want of conductivity at rail joints, but since then the superintendent has taken a large number of such readings and has in several cases found at steam railway crossings, etc., places where the drop or difference in pressure would be at times as high as five to eight volts, which means that there was an open circuit, or about such a condition of affairs as would result if a wire was lying on the ground and should be cut in two, leaving the two ends very near each other but not touching. The street railway company is now making a very full and careful examination of rail joints and other places where electrical deficiencies may be found and its experts will soon send in a report. Readings have been taken near where the return wires leave the track and are carried to the new power house, placing one wire in the bottom of a large mill race or canal and the other on the rails, and readings obtained for a few seconds as high as six or seven volts, which shows that a large percentage of the return current was coming back to the power house along the water main which runs under the bed of the stream and along the bottom of the canal which is connected with both the Kalamazoo river and its tributary, Battle creek.

Quite strong electric currents have been found passing along the rails of steam railroads having such irregular and varied direction and pressures that nothing but a complete electrical survey of the entire surrounding district would enable one to have a clear idea of the exact cause of their divergence. Currents have been found that passed directly away from the power house, then were deflected along water mains until they reached a point a mile out of what seemed the proper course for their return, when they suddenly took a somewhat more direct course to their final destination. In several places distant from the power house, where the mains were large, readings taken from the hydrants to the rails, when cars were near and load was heavy, showed

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strong currents passing from the rails to the hydrants, which indicated that the current was not getting an easy path on its return by the rail, and in all probability the water mains were receiving small amounts of current at almost every length of pipe, the aggregate of which in a mile or two would be considerable. In Detroit the rope or yarn used for making the joints of a portion of a main that had been cut was set on fire by the passage of the current across the gap left when the pipe was about to be jointed.

Our electrical street railway friends began bonding their rails with an iron wire one-eighth of an inch in diameter. After they found that this would not work it was increased to ¼-inch diameter and made of copper; then to 1-3-inch diameter; then two of the last named bonds were used, and now the better roads are bonded with two copper bonds about ½-inch diameter, or with stranded wires or flattened strips of copper of an aggregate section equal to ½-inch diameter. Bonds are made and have been in use for years that have an electrical carrying capacity nearly or quite up to that of the full section of a 70-pound rail; but these are still given the cold shoulder by nearly all of the street railway companies, and probably none of them are in use in any but the largest systems. Yet, it is asserted by some of the best electricians in the country, and is believed by the writer, that such a bond as this, which would be equal to a piece of solid copper rod about one inch in diameter, would not prevent the return currents of a moderate-sized street railway system from having an undesirable portion diverted to other conductors than the rails. In other words, if the average street railway in a moderate-sized city could have its rails all welded together the current would still escape to water and gas mains.

The use of larger and better constructed rail bonds, and the addition of bare supplementary wires laid between the rails and connected, say every 200 feet, or insulator wires carried alongside the track on poles and connected with the rails every 300 or 500 feet, would greatly improve many of the returns of street railway currents at the present time. Even the running of overhead wires connected to the track in but few places where there was more than the usual lack of returning capacity, would be of value. This has been done in Grand Rapids, Mich., using ten return wires, and is quite successful. But when we understand that there is from one to two hundred up to thousands of amperes of current used by the lines now operated, and that one ampere will destroy 25 pounds of iron, or 75 pounds of lead in a year, and that in many places the rails are returning but 10 to 30 per cent. of their total output, it is easily seen what fearful havoc may be brought about.

Of one thing we may rest assured, better return conductors must be devised, or the great increase in the number and weight of cars will soon make the operation of a single trolley street railway an unbearable nuisance.

If we are to believe the electrical engineers having the greatest experience in investigations of electrolysis, we must accept as a fact their statement that the double trolley system, or an underground system in conduits, well insulated, is the only complete cure known for electrolysis. To be sure, a great improvement can be made in many street railway lines by careful and frequent examinations of all joints and rails and a correction at those places found deficient, and this may be sought as the only available remedy at present.

It is doubtful whether there is any economy in the construction and operation of a single trolley line as against the double trolley except in the matter of original cost, and there the difference does not exceed $1,000 per mile. In fact, if the rails are bonded to the extent that the best authorities recommend, the chances are that the cost would be fully as great for the single trolley as for the double trolley. No bonds are of any use where the double trolley system is adopted. The Cincinnati street railway lines have two hundred miles of track, and their management says that the original system of double trolley line has been so satisfactory that several single trolley lines, which have been purchased and added to the system, have been changed to the double trolley and the company is satisfied that there is an economical saving over the single trolley in their expenditures for maintenance. All new street railways in the suburbs of Washington, D. C., are required to put in the double overhead trolley system, and in the central portions of the city the conducting wires are required to be placed in underground conduits carefully made and with the wires well insulated.

It is the belief of excellent authorities on water works construction and maintenance that the life of a water pipe in the average soil will be at least doubled or trebled by the addition of a coating of coal tar pitch or similar preparation put on at a high temperature. A six-inch gas pipe in Battle Creek which has been in use for thirty years shows no sign of rust on its exterior surface, and there seems no reason why a water main should not last equally as well. Where electrolysis takes place, even to a moderate extent, this coating is so far destroyed that it loses nearly or quite all of its value as a preservative. It takes but a very small portion of the cur-

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rent of a street railway to injure this coating. If the water pipe is near the rail it might readily be done with a difference in potential not exceeding one-fourth volt. No water system in the United States has received so great injury as that of Dayton, O., where over two miles of water main besides many services have been so badly injured as to probably require their speedy removal. This city has brought suit against the street railway company for $70,000, and since the filing of the original suit has added several thousand dollars to the original bill. The natural gas company of Indianapolis, Ind., began a suit against the street railway company, which has greatly injured their piping system. The local court decided that a remedy was available to the street railway company, but no remedy was available to the gas company, therefore, the street railway company was liable for damages and must apply the proper remedies or pay the same. The suit was for $50,000 damages and the natural gas company seemed to have proved that damage had actually taken place, but the street railway company still held that it was not liable. The case was carried up to the Superior court, the street railway company demurring to the ruling of the lower court. Judge Carter of the Superior court overruled demurrer and practically decided that damages must be paid. It is thought that the street railway company will appeal to the Supreme court of the state. If it does, let us hope that an early decision will be rendered. The water company of Indianapolis is also preparing to bring suit against the street railway company, and it is claimed that great damage has taken place. The officers of the company are unable to state how much, as it would require an expensive examination to even approximate the amount. Suit has been brought by the Peoria, Ill., water company against the street railway company in that city asking for an injunction to restrain the street railway company from allowing its currents to get upon the ground in any manner.

Franklin, O., where great damage has been done to all pipes on one side of the river by a suburban line passing lengthwise through the town, has begun suit and expects soon to bring the case to trial. The Spokane Falls Gas Light company brought suit some time ago against the Spokane Street Railway company. It was decided by the county court that the street railway company must within six months apply either cast iron welded joints or Chicago bonds to various parts of its line. It was contended by the gas company that the double trolley system should be adopted as that was the only known means of preventing stray currents from getting on gas-pipes. The street railway company, of course, did not want to be compelled to do anything. The decision seemed to have been in the nature of a compromise between these views, and was so unsatisfactory to the gas company that, although it had practically won the suit an appeal was taken to the Supreme court, but no hearing has yet been had before that court. In the meantime most of the experts who had examined the welded joints have decided that while it is a good mechanical appliance for carrying the car wheels over joints it is anything but a success as an electrical conductor. The Chicago bond which is a bundle of small wires with an annular terminal or end piece made to fit in a hole bored near the end of the rail, through which a pin is driven which expands it to the full size of the hole, has been partially displaced by similar forms of bonds with a solid and longer terminal which is expanded by a strong hand power machine made for the purpose. Several suits have been started and are under way in other cities and in a few places street railway companies have paid moderate sums for damages produced by electrolysis. The apathy with which municipal officers especially act, who would otherwise have great influence in compelling a proper decision, is greatly to be regretted. It is partially with a view to correcting this evil that agitation on this subject should be kept up by all those who desire a proper solution of the problem.

The damage to gas mains is still greater than to water mains, because the perforation of the gas pipes produces leakage, which, passing into the basement of the buildings is ignited, and an explosion takes place that in several places has wrecked the buildings.

The question is frequently asked what legal action shall be taken by legislative bodies in order that there shall be at least a lessening of the injuries due to electrolysis in the future. The question is easily asked, but a law that can be practically carried out is not easily devised.

It is said that several state legislatures will have before them during this winter's session, for passage, bills providing for exemption from damages due to electrolysis.

Battle Creek has passed an ordinance which is more full and complete than any the writer has seen. The main points of the ordinance are that all new lines shall be provided with a double trolley, and that should any line be allowed by law to use the single trolley system it shall be required to put in a very complete and expensive bonding. It is believed that a street railway company could put in a double trolley system at least as cheap, if not cheaper, than it could comply with the bonding required by this ordinance. It was not expected that the bonding as set forth in the ordinance would be strictly followed, but if the single

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trolley system should be allowed the best known bonding at the time could be secured in lieu of that required by the ordinance. This ordinance also fixes the maximum difference in potential or voltage that may occur at any time between the gas pipes, water pipes and other similar substances on the one hand, and street railway track on the other hand at one-fourth volt. This is a very close restriction for a single trolley railway, there being in Battle Creek occasional momentary readings of five to eight volts, and several places where the average would reach two to four volts in the summer time, when the travel is heaviest.

In many cities there is a difference of voltage, or pressure, as high as twenty or thirty volts, and there are some cases where it has largely exceeded these figures. The ordinance also requires all street railway companies to make full and complete electrical examination of their return conductors every six months and furnish copies of the results to the proper city officials. In case the examination shows deficient conductivity it is required to be made good within three months of the date of examination. The best and most modern devices for conveying electricity are required to be installed and used. Street railway companies are made responsible for damages and proper penalties are attached for failure to comply with the conditions of the ordinace.

There are 18,000 miles of electric railway and 50,000 cars in the United States, which is nine times that of the year of 1900.

It is the opinion of the writer that almost every small town in Michigan will, in a few years, have its electric street railway lines, and should there be no improvement made so that some other and better means of transportation—such as the automobile may possible become—is devised, the state will be gridironed with these lines within the next ten years. Municipalities and water and gas companies should, therefore, do the utmost possible to reach the proper remedy for the evils due to electrolysis soon, and should then place on the statute books such legislation as will bring about a complete change in the present methods of returning the currents of street railways. In Ft. Wayne, Ind., 1,000 feet of twelve-inch water mains was removed because of the damage done from electrolysis. It has not been stated publicly what the damage aggregated, but if on a well-paved street it certainly could not be less than four or five thousand dollars, supposing that the service pipes were also injured, which is more than probable. There are not less than seventy cities which have publicly stated that the damage had been done by electrolysis, and at least one prominent electrical engineer affirms that in his opinion there is not a single city where the single trolley system is in use that damage has not taken place.

In reply to a circular letter sent out by the writer to thirty-five cities, replies were received from fourteen. Several had not even investigated the matter of electrolysis. Five or six had given the matter most serious attention—most of them having had examinations made by experts. These nearly all report damages to either water or gas pipes, in some cases the damage being almost entirely confined to one set of pipes. The superintendent of the water works of Cincinnati reports no damage since all of the lines in the city have been put under the double trolley system. He seems so confident of safety that he has given the matter but little attention for several years past, although no doubt called upon to give his opinion as to the value of the system as used in his city. He reports serious damage on a single trolley line that has lately been changed to a double trolley.

Nearly all report no legal action either past or contemplated, although four or five have some provision in the franchise granted the street railway company, by which it would be partly or wholly responsible for the injury done pipe systems. Some have tried to get ordinances passed and failed. Only three reported having been paid for damage done, although three others had presented bills, which were refused payment. Several were only seeking exemption from future damage and would be glad to let the past go if that was accomplished. Several stated that they would join with other cities and water and gas companies to procure legislation prohibiting street railways from returning their current in water and gas pipes, while others were doubtful as to their authority to agree that this should be done, but otherwise appeared willing. To the question as to whether the street car company had negotiated with water works and gas companies in a spirit of fairness and with readiness to do those things that would bring about better results, the replies of several indicate no negotiations with the street railway company, or no necessity of any. One replied that the negotiations were all that could be expected; that they were entirely fair. Peoria, Ill., reports that the water company offered to pay one-half the cost of the change from single to double trolley, up to $10,000, for its half, and to waive all claims for past damages. This offer was rejected, so suit was brought. One reports that he has not and never will negotiate with the street railway company. In this same city the gas company has brought suit for $50,000 damages, and the water company is preparing to take similar action. Judging from the information that is available to the writer, about one-half the street railway companies meet the water

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and gas companies in a spirit of fairness and with at least some attempt to remedy the evils complained of, while the other half resist with more or less tenacity every attempt to bring about a better condition of affairs on the part of those injured, and in some cases go so far as to utterly ignore every attempt that the water works or gas companies can devise to collect damages for past injuries or to protect themselves in the future.

CURRENT INFORMATION

Massachusetts Highways.

The eighth annual report of the Massachusetts highway commission, which is composed of W. E. McClintock, Harold Parker and John H. Manning, has been published. The report states that the most serious defects in the old town highways which are reported for improvement, are the heavy grades. These are not only a tax on the user, but a constant and burdensome cost to the municipalities caring for them. The wash of storm water is much greater on heavy than on light grades, as is also the wear and tear due to the horses' feet. Taken as a whole no one improvement makes a better return for the money invested than the cutting down of hills. Whatever is done in this direction becomes of permanent benefit, and whatever the character of traffic, does not need to be done a second time. By carefully grading a road throughout its entire length between two centers of population or business, the possible load is increased notwithstanding no particular effort be made to improve the surface. The commission with these facts in mind is finally convinced that frequently more immediate benefits will result from laying out longer sections of state road at one time, and doing the grading on these sections in advance of the gravel or macadamized surface. The commission is also satisfied that the cost of carrying on the work can be materially decreased under such a system, as it will be possible to advertise larger quantities of each class of construction.

The commission employs about the same methods of construction now as those first used. With the exception of peat, muck and vegetable loam, experience has shown that all soils in the latitude of Massachusetts make a good support for roads during the greater part of the year. Sand, gravel and porous soils give no trouble at any time, while clay, sandy loam and all non-porous soils are much weakened by frost action, and in their natural condition afford poor support in the spring months, although they can be greatly improved by removing the ground water from them. The committee estimates that non-porous soils, drained of ground water, will support in their worst condition a load of about four pounds per square inch, and the thickness of the broken stone is adjusted to the traffic on this basis. If a division of the load in pounds at any one point by the square of twice the depth of the stone gives a quotient of four or less, then the road foundation will be safe at all seasons of the year. On sand or gravel, the commission believes that twenty pounds per square inch may be safely placed. Acting on this theory, the thickness of stone on state roads varies from four to sixteen inches, the smallest thickness being placed over good gravel or sand and the greatest over heavy clay. Where the surfacing exceeds six inches in depth, the excess may be broken stone, the choice depending entirely on the cost, for all are equally effective.

All broken stone now used on the Massachusetts state roads is separated into three sizes by passing it through a screen with meshes one-half-inch, one and one-half and two-and one-half inches in diameter. The sub-grade and each course of stone are thoroughly rolled, and the top course is watered before rolling.

The money invested in crushing plants in the state is estimated at $574,000. All of these plants, whether employed in state or municipal work, are fitted with elevators and revolving screens so that the stone passes through the crusher, elevator and screen into the bins, and from them into the carts without rehandling. Particular attention is paid by the engineering department to the selection of the rock for the roads, traffic, first cost, and cost of maintenance being taken into account.

Trap rock is considered the most economical material for the surface of roads with heavy traffic. Where it has to be moved long distances and its cost is high while a low-cost native stone is available, the latter is used as a bottom course and the trap rock for the wearing surface. In a few cases the native rock surfacing has not worn well, the cost of maintenance has been considerable and the surface of the road has become rough. These have been broken up by picks in the wheels of steam rollers, evened up, and resurfaced with two to three inches of trap rock with the proper amount of screenings, water and rolling.

All state roads are compacted by the use of steam rollers during both construction and permanent repairs. The steam roller is

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believed to give quicker, better and more economical results than can be obtained by any other method, with a properly prepared sub-grade; and by rolling the sub-grade and each course of stone separately no difficulty is experienced in using steam rollers that cannot be overcome easily. At the close of last year $429,000 was invested in steam rollers in the state, seventeen owned by the commonwealth, 102 by municipalities, and forty-three by contractors.

The standard width of broken stone roadways built by the commission remains fifteen feet, and on each side there is a width of three feet shaped to the same cross-section as the broken stone. These side strips or shoulders are covered with gravel on much-traveled highways only; on all others, the natural soil is used. Roadways of ten and twelve feet have been built and are satisfactory so far as their use is concerned, but the ten-foot roadway cannot be maintained economically except where the traffic is exceptionally light. Guard rails, to protect the traveler, are placed on embankments and at culvert ends. Where the cost is not much increased, the embankments are given a slope of one on four and the rail is omitted.

Paved gutters have not been laid as a part of construction since 1897. They are only built now where the gullying of gutters can be prevented in no other way. Either iron or vitrified clay pipes are used for culverts, up to twenty-four inches in diameter, the ends being in all cases protected by stone masonry. The larger culverts are built of rubble masonry, the side walls being laid dry and the ends in cement mortar. The commission lays much stress on the need of good materials and workmanship in all culvert masonry, for while the first cost of good work may be greater, the final cost is surely less.

Reference has already been made to the necessity of removing ground water from the sub-grade of the road. This drainage is effected in various ways, the kind of drain being dependent on the character of the soil. That most used by the commission is a vitrified clay pipe laid with open joints in a trench three to three and one-half feet deep and twelve to sixteen inches wide. The pipe is placed on a two-inch layer of fine gravel, free from sand or dirt, and is surrounded and covered to a depth of six inches by the same kind of gravel. The remaining part of the trench is filled with stone from one to three inches in diameter. Such a pipe is found to remove the water quickly to an outlet: the fine gravel allows a free flow of water, and at the same time prevents the passage of silt into the pipe; the removal of sand or dirt from the fine gravel surrounding the pipe removes the possibility of its entering the pipe; and the coarse stone in the upper part of the trench intercepts the ground water in its flow toward the sub-grade. These drains are placed on either or both sides, as the contour of the ground requires.

There are many of the main roads that might well be surfaced with gravel, and its use would satisfy the requirements of the traffic. In Massachusetts, however, good road-building gravel is a scarce article in comparison with stone. Its use is practically prohibited when the supply has to be carted more than one and one-half miles, or when screening is necessary to remove a surplus of fine sand or of coarse stone. Some of the gravel roads have been made from the material as it came from the bank. In other cases it has been separated by screens with meshes one-half inch, one and three-quarter inches and two and three-quarter inches in diameter, each size being spread and rolled separately. In still others, the gravel from the bank has been run through the crusher, broken and screened, and laid in courses and rolled in the same manner as broken stone.

Three years ago an interesting experimental road was built in Truro, near the extreme end of Cape Cod, and has proved a success. The soil here is loose sand with practically no surface loam. The drainage is perfect. There is not much snow or frost during winters, and the traffic is light and small in volume. The loose sand sub-grade was shaped to the desired cross section, and on this was spread a natural mixture of 1 per cent. sand and two parts of clay; this layer was two inches deep. Over it was spread a three-inch layer of stone broken to sizes ranging from one-half to one and one-half inches. This broken stone was covered with a one-inch layer of clay and a long-toothed spike harrow was dragged back and forth until the clay and broken stone were well mixed. The entire surface was finally watered and rolled with a two-ton roller, and since its completion an occasional sprinkling of sand to prevent the clay from becoming muddy is all the work that has been needed to keep the road reasonably smooth and free from loose stone.

The experience of the commission has convinced its members that better results are obtained and money is saved by maintaining the roadway in good condition at all times by a system of continuous small repairs, rather than leaving it until it is practically worn out and then thoroughly rebuilding. The commission is also convinced that a thorough consolidation by a steam roller in the spring, after the frost is out, but before the sub-grade is dry, is one of the best means of keeping a stone road in good condition.

For ravelling and the loose fragments of stone scattered over the surface of a roadway in consequence, the commission has

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found that sprinkling sand over the surface as often as needed has given a greater degree of satisfaction than any other remedy. This coating of sand is a small fraction of an inch in thickness and is spread over a width of about eight feet in the center of the highway. Treatment several times during the year is required by some of the roads exposed to the wind, while others with less exposure need but little attention. Heaps of broken stone are scattered alongside most of the state roads to be used as occasion requires in filling slight depressions or for emergency work.

Charles Mills, chief engineer of the commission, has carefully investigated the wear on the state highways. Cross-sections were taken at forty places and it was found that the elevation was 1.03 inches lower on an average than the original elevation. The figures for roads built in each year are shown in the following table:

Year built.....	1895	1896	1897	1898	1899
No. of sections..	7	9	12	7	2
Crown Ins. per ft. original	0.694	0.583	0.645	0.625	0.688
In 1900.....	0.500	0.514	0.500	0.500	0.625

While the roadway is of first importance, the commission has not lost sight of the educational effect of a well-kept roadside. The space on either side between the roadway and the boundaries of the right-of-way has been cleared of debris and generally smoothed up. Trees that would afford shade or add beauty have been carefully preserved and the planting of shade trees has been encouraged. On two of the state roads, eight and eleven miles long, men are employed who spend their entire time cutting brush and weeds, cleaning waterways and gutters, trimming down shoulders and filling washouts.

New Jersey Road Improvements.

The seventh annual report of Henry I. Budd, state commissioner of public roads for New Jersey, for 1900, has been published. An instructive addition to the report is a large road map, showing the free and toll roads built in New Jersey under the law, where these improved roads are, and how much has already been accomplished. The pressure for new roads in New Jersey is so great, says Mr. Budd, that the people are constantly building ahead of the state appropriation. Last year, while the appropriation made only authorized the construction of eighty miles of road, about 140 miles were actually built or are under construction. Mr. Budd, in view of this public demand for highway improvement, recommends an increase in the annual state appropriation from $150,000 to $200,000. He suggests, also, that the state aid law be so amended as to allow the counties to raise one-half instead of one-quarter of one per cent. upon their ratables. While this latter amendment was once passed by the legislature but failed of approval, yet the present condition of the state treasury and the 30.3 per cent. rate of increase shown by the last census would justify its re-enactment. The increased cost of road construction in New Jersey is explained by Mr. Budd, who says that the price of labor has advanced about 20 per cent.; the railroads advanced their charges from 10 to 20 cents per ton. A combination among the quarry owners made the average ton of stone in the road bed cost at least 50 cents more than the previous year's quotations. These increases have made the roads in the southern and central portions of the state, which are distant from stone quarries, cost fully one-third more than before.

The question of gravel vs. broken stone for road construction in Monmouth county is being discussed, as a result of the increased cost of broken stone. Public sentiment seems to approve of the gravel construction as being much cheaper at $1,439 per mile than $8,571 for stone, and as wearing well and being more cheaply kept in repair.

The tendency of improved roads and trolley lines, Mr. Budd points out, is to scatter the population, and is gradually relieving the congestion of large cities. He says:

This is shown in the decrease of rentals near the center of the cities, from one-third to one-half, and the increased value of suburban property for rental purposes. Free rural mail delivery, recommended by the postmaster-general, will add to the advantages accruing from better roads.

He says that while roads in different parts of the state are constructed of varying depths, some of telford and most of them of macadam, experience has shown that the most satisfactory roads are made with six inches of macadam and fourteen feet wide. These roads are made of two layers of stone, each four inches deep, rolled down to six inches. The plan of building these roads by blocks, or placing cubical blocks four inches in size, and requiring all loose stone to be filled to the surface of the blocks has been adopted by the engineers. This insures at a glance the proper depth of stone.

Embodied in the report are two contributions by R. A. Meeker, state supervisor, upon road materials and the maintenance of macadamized roads, and other special articles.

Standard Specifications for State Aid Roads in New Jersey.

The standard specifications for roads built under the state aid laws have recently been revised by the association of state and county road engineers of New Jersey.

Plans, profiles, cross-sections, specifica-

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tions and estimates of quantities in sufficient detail to enable a bidder to submit a lump sum tender for the entire road construction, must be furnished by the engineer. The bid, however, must be accompanied by an itemized price list from which the monthly payments can be made out. These amount to 80 per cent. of the work done; of the remaining indebtedness, 15 per cent. is paid when the work is accepted and 5 per cent. is retained as a guarantee fund that the contractor will keep the road in repair for one year from its acceptance, which is a part of his contract. The accuracy of the estimates of quantities is not guaranteed by the county, nor are any important deviations from the plans or extra payments permitted, except by a written agreement of all parties, including the state commissioner of highways. It is particularly specified that on all drawings, figured dimensions shall be accepted in all cases of discrepancy between scale and figures.

The revised specifications contain the following requirements: The roadway excavation must be made to the lines shown on the drawings. The soil must not be removed from the line of the road without the engineer's permission, and he alone may say where it may be placed; generally he sends it to the embankments, either for the roadway or sidewalks. The embankments are formed in layers of such thickness, usually 12-ins., as the engineer orders, the correct allowance for shrinkage being added. All slopes of cuts and fills are 1-½ to 1, except when otherwise ordered by the engineer. The contractor is required to leave or make, on each side of the finished roadway, a shoulder of firm earth, which will prolong the surface of the carriageway to the side ditches. This shoulder is rolled as the engineer requires. The side ditches are staked out by the engineer as needed. Four-in. tile underdrains with joints covered with salt hay or equivalent material are laid on one-inch plank six inches wide, where he may designate, or a stone drain may be used. This is made by filling a trench one foot wide and one and one-half feet deep with loose, broken stone. When the excavation and embankment are finished, the surface must be rolled until approved by the engineer, all depressions being filled and poor material removed as the work progresses. Water is sprinkled in advance of the roller when the engineer directs, and the roller itself for this and other parts of the work must be of a weight fixed in the specifications for the work or by the engineer. General requirements are provided for all classes of telford and macadam, although the thickness of the various courses is given in the specifications. Where a telford foundation is to be made they provide the following:

It is to be set by hand as a close, firm pavement, the stones to be placed on their broadest edges lengthwise across the road in such manner as to break joints as much as possible, the breadth of the upper edge not to exceed four inches. The interstices are then to be filled with stone chips, firmly wedged by hand with a hammer, and projecting points knocked off. No stone of greater length than ten inches or width of four inches shall be used, except each alternate stone on outer edge, which shall be double the length of the others and well tied into the bed of the road; all stones with a flat, smooth surface must be broken; the whole surface of this pavement to be subjected to a thorough settling or ramming with heavy sledge hammers, and then rolled. No stone larger than two and one-half inches is to be left on top of the telford.

In macadam roads the first course is to be of 2½-inch stone, or such as will pass through a 3-inch ring. No stone is to be less than 2 inches long. This course must be watered in front of the roller when the engineer so requires. The depth of the loose stone in this and other courses is to be fixed by blocks of the desired thickness placed on the sub-grade at frequent intervals while the stone is being spread. Binder is spread uniformly on this first course and rolled, with sprinkling if so directed, until the stones cease to sink or creep in front of the roller. The quality and quantity of the binder are subject at all times to the approval of the engineer.

The second course is to consist of 1½-inch stone, that is, such as can be passed through a 2-inch ring and is from 1 to 2 inches long. This is spread, rolled and covered with binder like the first course.

When the two courses have been finished satisfactorily, a coat of 50 per cent. of ¾-inch stone and 50 per cent. of screenings, properly mixed, is to be spread of sufficient thickness to make a smooth and uniform surface to the road; then rolled again until the road becomes thoroughly consolidated, hard and smooth. Depressions are to be filled with fine stone and screenings, and water is to be used when the engineer so directs. In rolling, the roller is to start from the side lines of the stone bed and work toward the center, unless otherwise directed, and this part of the work is to be modified as much and as often as the engineer directs.

For stone the requirements are:

All stone must be as nearly cubical as possible, broken with the most modern crushing machinery, free from all screenings, earth and other objectionable substances, of uniform size, and the same kind and quality, or equally as good in every particular, as that shown in the engineer's office. The 1½-inch stone, the ¾-inch, and screenings for binder and finish must be of the best trap rock, free from loam or clay.

The specifications contain a clause relative to the old marks of boundaries of property, which is as follows:

The contractor shall not disturb the position of title stones .(the corners of property adjacent to the road) but where they appear he will either lift or lower them, under personal supervision of the engineer.

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Illinois Central's Good Roads Special.

The National Good Roads association began, April 16, its first practical demonstration of road construction on its southern trip at Flossmoor, Ill., thirty miles south of Chicago. The "good roads special" consists of seven flat cars, bearing scrapers, sprinklers, a rock crusher and rollers, and a commissary and officer's car. Accompanying the train on its trip south were Senator Martin Dodge, director of public road inquiries of the United States department of agriculture; R. W. Richardson, secretary of the National Good Roads association; W. T. Beatty, representing the road machinery manufacturers; Prof. W. R. Hoag of the engineering department of the University of Minnesota.

How to Lay Tar Macadam.

Mr. W. C. Wingate, City Engineer of Hamilton, Ont., describes the method of laying tar macadam, and the results, as follows:

Last year our city constructed about 70,000 square yards of tar macadam roadway, costing $75,000, including curbing, which is half of the $150,000 fund that was voted on and appropriated for this purpose, leaving $75,000 more to be expended in similar work this year. Tar macadam was constructed by corporation labor and none by contract, and cost in the neighborhood of 95 cents per square yard, based on labor at 18 cents per hour and refined coal tar delivered found on board cars in Hamilton at $3.75 per barrel of 50 United States gallons. During the year 1899 there were about 4 miles of this class of pavement laid by corporation labor, and costing not quite 80 cents per square yard, but this was based on labor at 15 cents per hour and coal tar at $2.60 per barrel. The stone used is of a hard bastard limestone, quarried within the city limits and with an average haul of 1½ miles, cost about $1.15 per cubic yard for the hand broken stone, and 95 cents for the machine broken or crushed stone delivered upon the site.

The advantages claimed for this pavement are that it is free from dust, easily swept compared with plain macadam, and, owing to the tar mixture causing a complete adhesion to the stone, making it impervious to water, and thereby holding the pavement in a permanent position as originally laid, and no moving or rolling of stone as often experienced in a plain macadam roadway. I might mention also that there is no wear to the top dressing, as it is calculated that the latter will soon either peel off after evaporation sets in, or crumble away, leaving the large stones as a wearing surface. The dressing is merely intended to be evenly spread over the tar macadam and well rolled in with a heavy steam roller, and, as before stated, making the surface compact and close and impervious to water. With reference to the durability or lasting qualities of this class of pavement, I do not feel that I am yet in a position to say definitely, owing to the short time it has been laid; but I have every reason to believe that the same will prove durable, fairly clean and free from dust, easily swept, and will require to be repaired only every third year on the principal streets where the traffic is heaviest, and on residential streets, where the traffic is light, every fourth or possibly fifth year, by spreading a new coating 2 inches thick of tarred stone with dressing on the full width of roadway, and at a cost not to exceed 25 cents per square yard. This, you will observe, divided by three years, would be 8 1-3 cents per square yard annually for the principal traveled streets, and for the residential streets from 5 to 6¼ cents per square yard.

The first tar macadam laid by the city of Hamilton was laid in the year 1880, a little over 20 years ago, on Mulberry street, one block of about 400 feet, by the Hamilton Gas Light company's people, and although this pavement is not in first-class condition today, an expenditure of 25 cents per square yard would make it nearly equal to a new roadway. There has been little or no expense on this pavement during all that time. The second tar macadam was laid in 1891, on West avenue, of about three blocks, or 1,200 feet, 22 feet in width between curbs, one of our principal residential streets, but the traffic was fairly light until the year 1896, when a large building, the Collegiate Institute, was constructed, necessitating the carrying of much heavy material over this street, and it was surprising the way the tar macadam stood the wear, the repairs of which have been only nominal, being a few holes that were patched up, making a pavement as good as formerly. These two latter pavements were laid in a most primitive way, and not to be compared to the manner in which we are doing the work now under the revised specifications; but notwithstanding the inferior work at the time, it is proving to be an economical roadway and has been the cause of our taking up the question of better pavement and the adoption of tar macadam. A third pavement with a somewhat better specification of tar macadam roadway was also laid in the year 1893 by the Hamilton Gas Light company's people, with a 10-year guarantee for maintenance of same, on King William and John-sts., two principal streets near the heart of the city, over which much heavy traffic passes, for a total distance of 4 blocks, or say 1,600 feet, for the sum of $1.75 per square yard. This pavement had little or no repair until the year 1899, when an arrangement was made with the Gas Light company, and the city was directed to make the necessary repairs and charge to them, the same having been completed over half of the distance and costing 31 cents per square yard; which, distributed over 6 years, from 1893 to 1899, would be 3½ cents per year.

In this connection it might be well for me to mention that many deputations from various cities throughout the United States have visited us during the past two years on inspection trips for the purpose of seeing for themselves this pavement as laid on our streets, and so far as I can ascertain they have all been favorably impressed, and I have heard from several

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stating that they had concluded to adopt tar macadam in their own cities.

I am aware that tar macadam is not a new thing, as it was used years ago in the old country with more or less success, but in the states it has generally proved a failure, particularly so in Washington, where it was tried and failed in the year 1871. Very recent cases have been tried in the state of New York after parties had visited us and tried to do as we had done, but I have learned that it was a partial failure, and upon request I sent a man from here to help them out of the difficulty the best he could, which he succeeded in doing.

These failures are caused by not having the proper knowledge pertaining to the tar mixing, which is essentially a job that must be left to the discretion of the man in charge, as it is quite difficult to fix any hard and fast rule, as so much depends upon the quality of the tar, the temperature while heating, the dryness of the stone and the quantity of pitch. Then, too, it is absolutely necessary to have hard, porous rock which is found in the limestone. With the use of broken granite for a tar macadam roadway one would have very little success, owing to granite being so close grained that it will not absorb the tar, unless thoroughly dried and baked on hot plates, which makes it expensive.

Pavements in Michigan Cities.

A committee was appointed recently at Hillsdale, Mich., to visit the different cities in the state of Michigan for the purpose of examining the pavements in use, and to ascertain their cost, relative merits as to durability, practicability, desirability, etc. Mayor H. C. Blackman, chairman of the committee, states in the report that owing to the fact that for almost the entire period of time that has elapsed since the committee was appointed snow has covered the streets of all the cities of Michigan, the committee, deeming it unwise to secure the information desired by visits to these cities, has procured by correspondence a valuable fund of general information on the question of pavements from mayors, clerks and city engineers of the cities addressed, which, summarized, is as follows:

Kalamazoo—Uses brick, asphalt block and macadam. Advises use of brick on business portions. Cost, brick, $1.61 per square yard; asphalt, $2.17. Laid by city. Foundation, concrete under brick, sand and asphalt. Holds its evenness of surface (the brick) on concrete foundation, and gives no trouble in restoring surface after excavating for water, gas, etc. Basis of assessment, one-third borne by city, two-thirds by abutting property.

Coldwater—Uses brick and considers it best for towns of its size. Cost, 1898, $1.35 per yard; 1899, $1.28 per yard. Laid by contract, on six inches of concrete. Holds its quality of surface fairly well. No trouble to restore surface after excavation. Two-thirds of cost assessed against abutting property.

Monroe—Uses repressed block, and considers it good. Laid on crushed stone, twelve inches. Holds its surface well. Thirty-five per cent. of cost assessed against property.

Big Rapids—Uses cedar block, laid on sand and boards. Has not retained its evenness of surface; trouble with restoring it after excavation. Cost not stated.

Saginaw—Uses brick and asphalt. City engineer considers asphalt best known pavement when in proper condition, but very expensive to keep it so in our climate. Renders it an expensive luxury. Brick more durable and less expensive and for these reasons preferable on business streets. Cost: Asphalt, $1.52 to $2.90; brick, $1.30 to $2.75. Most of their pavement laid by contract, and on 6 inches of concrete. No trouble with either in restoring surface after excavation. Both hold equality of surface. Cost borne by the property especially benefited, except street intersections, borne by city. Five or ten-year bond issues.

Jackson—Uses brick and considers it best. Cost: From $1.70 in 1891, to $1.24 in '97 and $1.34 in 1899. Laid by contract. Foundation, in 1895, and prior thereto, sand and gravel; subsequent to 1895, on 6 inches concrete. Holds its evenness and equality of surface on the concrete. Main street, which was not laid on concrete, very uneven as result of excavations, etc. On concrete much easier to restore original surface after excavation and retain its original evenness; no inequality need result if care is taken in restoration. Property-owners pay four-fifths of cost, city standing expense of alleys and street intersections.

Pontiac—Uses asphalt block and considers it best. Cost, $1.77 per yard for material. Cost of laying pavement not stated. Laid by contract on concrete where there is heavy traffic and gravel elsewhere. Holds its equality of surface. Easy to restore after excavation—city clerk says easiest on the market. City bears one-sixth of expense, street railway "their portion," and property-owners the balance.

Benton Harbor—Cedar block and brick. Considers brick or asphalt best. Block cost $1.20 per yard and 48 cents per foot for stone and curbing; brick 90 cents per yard. Block laid on sand and boards, brick laid on sand. After one year's service, brick holds its surface "fairly well." Difficult to restore surface after excavation. Abutting property pays 4-5 of expense. City also has one-half mile of asphalt, put in a few months ago at a cost of $1.73 per square yard, and 50 cents per foot of curbing. Considers it best in many respects. Difficulty of restoring surface seems to refer to cedar block, as other pavement has not been laid long.

Ypsilanti—Uses Metropolitan shale brick, which cost from $1.92¼ to $2.21 per square yard. Laid by contract, on concrete. Ten blocks laid from one to two years. Holds equality of surface. No difficulty to restore surface after excavation. Abutting property-owners pay all of expense except street intersections. Have privilege of paying in nine years, or ten installments. Interest on deferred payments at 5 per cent. per annum.

St. Joseph—Uses brick, and considers it best for business portion of city. Price not given. Laid on sand, well packed.

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Surface remains even after five years' use. Cost assessed against abutting property.

Owosso—Uses asphalt with brick gutters. Considers sheet asphalt best. Cost, $1.53 per square yard for asphalt and $1.40 for brick. Laid by contract on concrete. Holds its equality of surface after two and three years' use. Repaired and restored easily. Cost assessed, 59 per cent. against abutting property, 41 per cent. against city. (I learn from other than municipal sources that specifications were made to permit either asphalt or brick to be bid for, as there seemed to be a combination between the brick contractors to hold up the price. In the competition asphalt underbid the brick as a result).

Adrian—Uses brick Laid by city past two years, previously by contract. Laid by city at less than contract price, which was about $1.71 per square yard. Brick laid on six inches crushed stone. City paid one-third and abutting property two-thirds of cost. Surface remains even after use.

Ann Arbor—Uses brick on six inches of concrete and asphalt block on gravel. City engineer states that relative superiority of one over the other of these two pavements is a matter of opinion; city expects to lay asphalt block the coming year. Asphalt cost $2.21 per square yard, exclusive of curb and excavation. Brick cost 49 cents per square yard and concrete $3 per cubic yard, or $1.44 per square yard complete. Laid by contract, and the brick holds its evenness of surface after three years' use. Asphalt has been laid less than a year. Success of restoring surface after excavation depends upon care taken. Cost met by issue of bonds, and city pays for street intersections and 20 per cent. to 25 per cent. of the remainder.

Lansing—Uses brick and regards it best for streets with heavy traffic. Cost from $1 to $1.50, exclusive of curb and drainage. Cheapest laid on sand, best on concrete. City engineer volunteers information that Columbus, O., laid brick on broken stone, but always had trouble through formation of cavities by settling of sand cushion, which is laid between the concrete and the brick in all of these pavements, into the broken stone. When proper brick is used, wears well under traffic. First laid there about six years ago, is on concrete and except where there are defective brick retains its evenness of surface. Surface easily restored on concrete foundation, but difficult on less substantial base, owing to subsequent settling, even under exercise of great care, especially in heavy soils. City pays for intersections, and as much more as common council decides, usually about one-third.

Ionia—Uses cedar block, but considers brick best and most practicable. Would not favor cedar block.

Mt. Clemens—Has replaced cedar block with brick, and considers it best. Cost $1.72 to $1.85, using old curb. Laid by contract on six inches of concrete. Holds its surface and easily restored when broken for excavation. Entire cost assessed against abutting property, except street intersections.

Grand Haven—Uses gravel on account of its convenience. Estimates cost at about $1 per square yard. City owns large gravel bed, and transports gravel by barges at low cost.

Manistee—Uses cedar block, and some crushed stone on less used streets. Block practicable for about five years, "then repairs come in fast." Will replace with brick. Twenty-five per cent. paid by city, 75 by property owners.

West Bay City—Uses brick laid by contract, at $1.74 per square yard, including concrete foundation. Laid about three fourths of a mile last summer. One-half the cost assessed against abutting property, and one-fourth by city and one-fourth by ward.

Bay City—Uses brick and cedar block. Considers brick best. Block cost $1.25 per square yard; brick, including foundation, etc., $2 per yard. Brick laid on six inches concrete. Holds its surface well, and can be restored after excavation if care is exercised in tamping sub-grade. Cost met by assessing 70 per cent. against abutting property, 30 per cent. to street fund and alleys to wards. Now lays nothing but brick.

Flint—Uses brick in business portions. Considers brick best. Costs $1.30 to $1.50, exclusive of curbing, mostly laid by contract. Foundation, six inches concrete. Holds its equality of surface, and restored fairly well after excavation if properly done. Cost met by assessing 75 per cent. against abutting property and 25 per cent. by the city, including street intersections. Property-holders pay 1-5 each year for five years, with interest on obligations issued.

Battle Creek—Uses brick and asphalt block. Considers brick best and most practicable, average cost of which was $1.32 per square yard. About 4,000 feet laid by contract, balance by city. Two and one-fourth miles in use, first laid in 1896. Foundation, six inches concrete. Surface remains in good condition, and can be restored after excavation with care exercised. Two-thirds assessed against abutting property, by sale of bonds.

There appears to be no crushed stone or macadam used on the business streets of any city in Michigan, and I therefore corresponded with a few Ohio towns where it has been used. Briefly summarized, the information adduced is as follows:

Van Wert—Paved two streets some years ago with crushed stone, of macadam, drawing the stone from quarries four miles distant, where there is abundance of material. It cost 60 cents per square yard for crushing and about the same for hauling. Cost of grading and rolling not stated. Was not satisfactory on business streets, soon wore in spots, making "chuck holes," was muddy in wet weather and disagreeably dusty in dry. Main street now paved with brick and considered best and most practicable. Their side streets are some of them still paved with macadam, and are satisfactory for light driving. They lay so-called stone roads in that neighborhood, leaving room for "dirt" road on one side. The macadam is used in wet weather, but the dirt road for the most part in dry weather.

Stryker—Side streets paved with macadam, main street with brick on six inches of concrete. The brick, including every-

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thing, cost $1.50 per square yard, the macadam, $1.59 per cubic yard, being laid about ten inches deep. Does not recommend the stone for business streets. Their streets are giving perfect satisfaction.

Other Property of Owners of Lots Confiscated for Improvements Liable for Balance Due.

The Indiana Supreme court rendered a decision recently reversing a judgment of the lower court regarding street improvements in Gas City, Ind. In 1894 certain streets in the city were improved under the Barrett law. In many instances the assessment amounted to more than the value of the abutting land. The Gas City land company took advantage of the payment by installments and signed the waiver and agreement in writing provided for in the statute, whereby it promised and agreed that it would make no objection to the assessments on account of illegality or irregularity and that it would pay the assesments, with interest. Default was made in the payments, and the whole amount of the assessments having become due by reason thereof, suit was brought by the Wayne county savings bank, the holder of the bonds, upon the said assessments and the agreements, in order to enforce and foreclose the lien given by the statute, and also for a personal judgment against the lot owner. The lower court held that the assessments were liens upon the lots, and the lots could be sold to satisfy the same, but that there could be no execution against the Gas City Land company for the collection of any balance remaining unpaid after the sale of the lots. The opinion of the Supreme court, written by Chief Justice Darling, was as follows

The statute imposed no personal liability for the cost of the improvement. It did provide, however, for the voluntary execution by the property-owner of an agreement in writing by which, in consideration of an extension of the time of payment and the privilege of making such payment in installments, the property-owner agreed to waive objection to all irregularity and illegality in the proceedings, and to pay the assessments. The Gas City Land company executed such an agreement. It was a simple contract, supported by sufficient consideration, entered into voluntarily and created a personal liability for the payment of the assessments. The lots assessed were primarily liable for the cost of the improvement, and, by reason of its agreement to pay the assessments, the Gas City Land company became responsible for any deficit of such cost, and interest, after the sale of the lots on foreclosure of the lien. The situation of the land company is much the same as if it had executed its promissory note to the contractors for the amount due, waiving all defenses arising from irregularities, payable upon the foreclosure of the lien, and subject to credit for the proceeds of the sale of the lots upon such foreclosure.

The lower court was ordered to render judgment for the sale of the lots and for the collection of any balance by levy upon and sale of any other property of the Gas City Land company subject to execution.

Lot Fronting Two Streets Can Be Assessed for Both Improvements.

A decision was rendered recently by Judge Caswell in the suit of O. H. Wallin vs. the city of Marshalltown, Ia. The plaintiff purchased a lot near the corner of N. First and Center-sts. Both of these streets were paved, the improvements thus abutting two sides of the lot. The plaintiff brought suit to enjoin the sale of the property for the assessments. Smith, Moss & Brown of Chicago, owners of the certificates, intervened. The plaintiff claimed that the city could not place two assessments on the lot and sell it for the two claims, alleging that it would be contrary to the constitution. In his decision Judge Caswell held that Mr. Wallin had purchased the lot prior to the improvements and was conversant with the situation, and that a lot fronting on two streets could be assessed for both permanent improvements.

In the paving case of Leonidas King against the city of Marshalltown, to restain the collection of paving assessments in N. Center-st., the plaintiff has appealed. The lower court decided in favor of the city.

Portland (Ore.) System of Special Assessments Unconstitutional.

A decision was rendered by Judge Bellinger in the United States court at Portland, Or., April 18, who held that the method of making the assessment for street improvements in that city is unconstitutional. The decision of the federal supreme court in the case of Norwood vs. Baker holds that the assessment for an improvement without considering the question of specified benefits is taking his property without due process of law, which is in violation of the fourteenth amendment to the constitution. This ruling overrules the demurrer of the city of Portland to the compalint filed by J. Thorburn Ross to restrain the chief of police from selling the Marquam building to collect an assessment for the improvement of Sixth-st. with asphalt.

Judge Bellinger's decision will practically suspend all new street work until the United States supreme court shall pass upon the constitutionality of the city charter.

Queens County Sprinkling Contract Void After Incorporation in New York City.

An opinion has been handed down by Justice W. G. Gaynor in the suit of Assemblyman Eugene F. Vacheron to recover a claim of $11,662 for sprinkling certain macadamized streets of the borough of Queens,

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from Aug. 1 to Nov. 1, 1899. The decision is in favor of New York City. The court held that the contract with the plaintiff had no validity after 1897. The charter was passed May 4, 1897, to go into effect Jan. 1, 1898. The power of the board of supervisors of Queens over the roads of the county was thereby limited to the period from May 4, 1897 to Jan. 1, 1898. The contract in question made July 6, 1897, was, therefore, invalid except for the rest of the year 1897.

The suit was brought for services rendered under a written contract between the plaintiff and the Queens county board of supervisors of July 6, 1897, whereby the plaintiff agreed to sprinkle certain county roads in Queens county for ten years and three months at $20,000 per year, or a total of $205,000. Payments were made by the Queens county board of supervisors for work performed in 1897 under the contract and in 1898 after mandamus proceedings, a total payment of $30,000. In a second mandamus proceding against the board of supervisors of Queens county to compel it to audit and pay plaintiff's bill for 1899, the appellate division denied Vacheron's application, saying that the claim was an obligation against the city of New York and not against the supervisors of Queens county.

Action was then commenced against the city of New York, a decision in which has just been rendered by Justice Gaynor. The plaintiff set up that the appellate division's opinion was based on the theory that the contract was a legal one. The city's defense was that the contract was null and void in the absence of legislative authority for the board of supervisors to enter into a contract for the sprinkling of the county roads, and that it was an attempt to deprive the successors of the board of supervisors of their power over the maintenance of such roads. The city maintained that it was against public policy in that the supervisors of Queens county, in entering upon the contract, did not act for the purposes of Queens county, but really for the purposes of the city of New York, for which they had no power to act. The court said:

I do not see how any distinction can be made in respect to the claim existing at the time the defendant, city of New York, was created against any of the municipal corporations that were made into it. The auditing power is discretionary.

Street Cleaning in Wilmington, Del.

In his annual report for the fiscal year, Harvey J. Wiley, secretary of the street and sewer department, Wilmington, Del., compares the conditions of the streets of that city with those of other cities of the same size and larger. He says the comparison shows that Wilmington has cleaner highways, and at less cost. The city has fifty-four miles of streets and avenues improved, which have been cleaned most effectively by hand brooms and the sweeping machines for general business travel. Owing to the prevalence of good weather the street commissioner found it necessary to keep the street cleaning corps at work for a longer season than has been heretofore practicable, and the cost for the year's cleaning was but a fraction more than $15,000, making an average cost of about $278 per mile of improved streets, or $196 to each 1,000 of the city's population, and one and one-half cents per square yard of improved streets.

The barrow patrol system for cleaning the streets has met with such general satisfaction that persons residing in those sections of the city where the system has not been introduced, have petitioned for such service. Mr. Wiley suggests the adoption of the hand patrol cart holding a nest of cans or vessels, by which means a patrolman will have sufficient vessels to be filled and set along his route to be collected and emptied into a wagon or cart, which will be required to follow and make collections from several districts; this scheme will permit a patrolman to remain at work upon his district at all times. The brick-paved streets in the business sections at least could be most effectively and thoroughly cleansed by flushing such sections at night with water from the fire hydrants.

Electrolysis in Hartford and Brooklyn

The attention of the board of water commissioners at Hartford, Conn., has been called to two cases of electrolysis which occurred during the month of March. In his report regarding this danger to the water pipes E. H. Judd, acting president, says:

As this is a heavy expense to this department on account of opening the improved pavement and paying for repairing same, we shall soon be obliged to resort to some method to see who is responsible for the damages. It does not seem right for this department to pay for opening and relaying improved pavement, when the leaks are caused by electrolysis. It will soon be a question whether this department shall keep on repairing the leaks at our expense or render the bill to the street railway company.

The water department of the borough of Brooklyn has also called the attention of the commissioner of public buildings, lighting and supplies to the electrolysis of underground pipes, with the request that the subject be investigated by that department, under whose jurisdiction it is placed by the charter of Greater New York. James J. Kirwin, deputy commissioner of public buildings, lighting and supplies for Brooklyn, suggests that the consulting engineer of lighting and electricity be requested to outline a plan for investigating

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New Whatcom Loses Its Water Supply by Court Decision.

The Washington supreme court has rendered a decision in which a perpetual injunction is granted restraining the city of New Whatcom from using Lake Whatcom as a water supply. The Fairhaven Land company, which operates a mill by power deprived from Lake Whatcom, asked for the injunction. The city expended $183,000 for a water works system, and is now without a supply.

Private Agreement to Shut Off Competition Cannot Be Enforced.

The Illinois supreme court rendered a decision April 18, in which it reversed and remanded the case of the R. F. Conway company against the Garden City paving and post company. The suit resulted from a private understanding between the Garden City paving and post company, the R. F. Conway company and A. J. McBean, who were bidders for the Laughton street paving in Chicago. The companies agreed to make the same bid for the work, then bid among themselves, the two lowest withdrawing and dividing equally the amount bid by the highest. The supreme court declares that it cannot enforce private agreements among rival bidders who enter into agreements to shut off competition. The court decides that the private contract is void for the reason that its object was to prevent competition.

Cincinnati to Appoint an Engineer on Grade Crossing Problem.

The board of legislation of Cincinnati, Ohio, has adopted a resolution authorizing the board of public service to appoint an assistant to its chief engineer, at a compensation of $2,500 per year, whose duty it shall be to devise ways of eliminating dangerous railroad grade crossings.

Another Phase of the Ogden Water Case.

A temporary injunction was granted by Judge Marshall of the United States court, April 9, which prohibited the city of Ogden, Utah, and its city officials from interfering with the cut-offs, valves, hydrants or other property of the Ogden Water Works company. Judge Marshall holds that the city of Ogden had no right whatever to interfere with the officers of the company when they shut off the water from delinquents. The plant did not belong to the city, even though the municipality held a judgment lien on it. The judgment lien gave the municipality no right whatever to dictate how the plant should be operated, or to exercise any control over it.

Judge Marshall did not pass on the resolutions passed March 16 and March 22, in which the citizens were requested to enter into no contracts with the water company and to pay no rates to anybody. He was in doubt as to whether or not he could legally enjoin the council from passing any more such resolutions. He thought the resolutions were called out by the notices sent around by the company telling their patrons to settle their bills and enter into new contracts. Referring to the resolutions of the council, Judge Marshall said:

Now they do not say in those resolutions not to use the water or, in other words, to boycott the company. They only ask the citizens not to pay for the use of the water. That is not right. There seems to be some sort of agreement between the defendants, perhaps not considered as an agreement by them, to prevent the payment to the plaintiff of water rentals due it. There is no justification for any action which prevents the collection of water rentals and still allows the use of the water by those who are delinquent in their payments for it.

Regarding the judgment lien, he said the city seemed to think it had the right to take possession of the water works plant. This was not correct. There were two ways of enforcing such a lien. One was to enter into peaceful possession of the property by agreement of the parties, and the other was to file a petition asking the appointment of a receiver. Neither of these steps had been taken.

Municipal Telephone Systems Authorized in Wisconsin.

The Wisconsin legislature has enacted a bill giving any municipality a right to issue negotiable bonds on the petition of a majority of its freeholders for the establishment and maintenance of a telephone system. The bonds are to draw 5 per cent. interest, and are to be made in twenty years, 5 per cent. being set aside annually for a sinking fund. With the maturity of the bond the plant is to become the unincumbered property of the township.

Judgment of Texas Court of Appeals in Favor of Contractors on San Antonio Sewers.

A decision was rendered in the fourth court of civil appeals, April 3, at San Antonio, Tex., reversing the judgment of the

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lower court in the case of Marshall, Backus & Hines vs. City of San Antonio. The following extract is taken from the opinion:

For the appellee to take and appropriate to its use appellant's property or money due them in its hands in the summary manner provided by the original contract it must bring itself strictly within the provisions of the contract. The evidence clearly shows that it has not done this, and in our opinion from the very nature of the contract, it is unable to do so, yet under cover of this provision of the contract it has confessedly taken and appropriated to its own use the sum of $26,641.79, which it admits appellants earned under the original contract. We have searched the record in vain for anything that gives the city a semblance of claim or shadow of right to this money, and have earnestly looked through appellee's brief of 123 pages to find something that would uphold the judgment of the trial court in sustaining this action, but in vain.

Reapportionment of Maintenance Charges of Metropolitan Sewerage District in Massachusetts.

A reapportionment of the amounts which the various cities and towns in the Northern metropolitan district should contribute to the cost and maintenance of the Metropolitan system of sewers, is necessary this year, and in accordance with the law, the Massachusetts supreme court must appoint a commission which will have authority to decide upon the percentage which each city and town should contribute. The law requires that an apportionment shall be made every five years, and the last one was made in 1896. The supreme court appointed a commission in 1891 to determine the proportion which each of the cities and towns should pay for five years to meet the interest and sinking fund requirement of the system each year, and also to meet the cost of maintenance and operation of the system. The court appoints three men on the commission, who are not residents of the cities and towns in the district. The court has ordered the petitioners to give notice to each of the cities and towns to appear before the supreme court May 6.

The Metropolitan sewerage system was built by an act of the legislature in 1889, and the northern district includes a part of Boston, Cambridge, Somerville, Walden, Chelsea, Woburn, Melrose, Medford and Everett, and the towns of Stoneham, Winchester, Arlington, Belmont, Winthrop and Wakefield.

Unconstitutionality of New York Labor Law Affects Brooklyn Bridge Contracts.

Justice McAdam of the New York Supreme court granted an injunction, March 28, restraining John L. Shea, as commissioner of bridges of the city of New York, and his subordinates, from awarding or entering into contract for furnishing all the labor, materials and plant necessary for the construction of the tower foundation of bridge No. 3 over the East river. Judge McAdam also set aside any award or contract which may have been made by Commissioner Shea, pursuant to advertisements issued, and bids received by him on March 11 from contractors. The plaintiff is Simon H. Bergoffen, who sues as a taxpayer, and claims that the lowest bid, which was made by Williams & Gentle, is irregular, and they are not, therefore, entitled to the contract. The irregularity claimed is shown in the fact that the company fixes two prices for each item. An item is cited for example which is as follows: "For completed work between the Datum plane and the horizontal plane 96 ft. below mean high water, $9,000, $18.00 per cu. yd." It is claimed that as the preliminary estimates upon which the contractors bid are only approximate, and may be more or less, the bid of $9,000, if intended for the whole work, might occasion either a loss to the contractor or to the city, according to the amount of work to be done.

The principal claim on which the application is based, however, is that the insertion of a stipulation requiring the contractors to obey the prevailing rate of wages law, or the cut stone or dressed stone law, or the labor law, which have recently been declared unconstitutional, makes the contract invalid.

Coloring Cement.

The qualities required in the colors used to color cements are: The property of thoroughly mixing; that of not decomposing under the action of lime, and that of resistance to the action of light, says La Ceramique. These colors should mix completely with the different compositions of which cements are made up, the cohesion of which they diminish. The means of testing them are to mix them with a certain quantity to a given quantity of slaked lime. Care must be taken not to use low-priced materials containing salts of lime and barytes, which give to the objects which contain them, especially when damp, a veiny aspect, which has a very bad effect. The colors for cements should resist the action of chemical alkaline agents. When washed by soda they should not be impaired after a day of this treatment. Those which mix well are unassailable by

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chemical alkaline agents and resist the action of light fairly well. The best means to assure one of these qualities is to color a plane surface and to cover certain parts with some opaque bodies and to expose the painted surface to the sun's rays for some time. The most common red is jeweler's red or brown red, composed essentially of peroxide of iron in the proportion of eighty-five per cent. at least. Red ochre (calcined) is less recommendable. The ochres, composed essentially of peroxide of iron and alumine of lime, constitute the yellows. These diminish very slightly the cohesion of cements. The ochres have also the advantage of being the less expensive yellows. Sienna earth (not burnt) may also rank in this category. Ultramarine is the blue most employed but it is well to correct the reddish reflection it has, especially in artificial light, by adding to it fifty per cent. of sea green. These three primary colors serve to compose the secondary shades—orange color, violet, green, etc.; neverless the lime resisting colors not always permitting certain mixtures, one has recourse to chrome greens, ultamarine and umber.

Water Park Proposed in Back Bay Basin, Boston.

The question of forming a water park in the Back Bay basin at Boston, by damming the Charles river, is being revived. The metropolitan park commission and the Massachusetts State Board of Haelth investigated the subject in 1894, but the project was dropped, owing partly to the opposition to the proposal to form land for another row of houses beyond the present Beacon-st. water front. This feature is omitted in the present plan, which is also different in other particulars. The plan includes a proposal for movable dams or gates in the proposed Charles river dam. The appointment of a state commission, to investigate and report on the subject, is the only action contemplated at present. A large part of the land bordering on the portion of the water front included in the scheme is already reserved for park purposes, either by the Metropolitan park commission or the several municipalities in which it is located.

Technical Meetings.

The twentieth annual meeting of the American Street Railway association will be held in New York City Oct. 9, 10 and 11. T C. Penington, secy., Chicago.

The annual meeting of the National Electric Light association will be held at Niagara Falls, N. Y., May 21 to 23. Geo. F. Porter, secy., 120 Liberty-st., New York City.

The spring meeting of the American Society of Mechanical Engineers will be held in Milwaukee, Wis., May 28 to 31. F. R. Hutton, secy., W. Thirty-first-st., New York City.

The annual meeting of the Canadian Electrical association will be held in Ottawa, Ont., June 19 to 21. C. H. Mortimer, secy., Confederation Life Bldg., Toronto, Canada.

The Municipal League of Indiana will hold its ninth semi-annual meeting in Columbus, Ind., May 8, 9 and 10. Mayor Z. T. Dungan of Huntington is president and Councilman Alonzo Kibbie of Columbus is secretary of the league.

The National Municipal League will meet in Rochester, New York, May 8, 9 and 10. James C. Carter, New York, president; Clinton Rogers Woodruff, Philadelphia, secretary.

The Society of Engineering and Applied Science is a new society organized at London, Ont., with officers as follows: President, Prof. Bowman; vice-president, F. W. Merchant; secretary, F. W. Farncombe; treasurer, R. Kirkpatrick. The society will follow the lines laid down by the Engineers' club of Toronto.

The American Society of Municipal Improvements will hold its next meeting at Niagara Falls the week beginning Sept. 30.

The eighth session of the Municipal League of Indiana will be held at Columbus, May 8-10. Among the papers to be presented will be the "New Street Improvement Laws," by City Attorney J. T. Merryman of Decatur; "Mayors, Their Duties and Powers," by Mayor M. T. Krueger of Michigan City. The tramp problem, curfew and spitting ordinances, public libraries, cigarettes, terms of office will also receive attention. Z. T. Dungan, Mayor of Huntington, is president.

Mayors Elected.

Mayors have been elected and re-elected as follows:

John N. Hinkle, Columbus, O.; Tom L. Johnson, Cleveland, O.; Samuel L. Jones, re-elected, Toledo, O.; M. L. Milligan, Springfield, O.; John L. Means, Steubenville, O.; C. Milstead, Portsmouth, O.; J. E. Smith, re-elected, Piqua, O.; Harry W. Mountain, Ironton, O.; Dr. J. I. Holden, Zanesville, O.; John J. Molter, Sandusky, O.; William B. Doyle, Akron, O.; Joseph H. Robertson, re-elected, Canton, O.; S. D. Emery, Owosso, Mich.; the Rev. Dr. I. S. Copeland, Ann Arbor, Mich.; J. W. Patch-

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in, Traverse City, Mich.; James Shanley, Albion, Mich.; John W. Howell, Marshall, Mich.; G. S. Stanley, Cadillac, Mich.; E. L. Rose, Petoskey, Mich.; W. A. Callen, re-elected, Centerville, Ia.; T. S. Fry, Mobile, Ala.; Henry Beckman, Kankakee, Ill.; Robert Rohl, Centralia, Ill; —— Sawyer, Monmouth, Ill.; Charles Shilling, Decatur, Ill.; Amasa Hutchins, Rockford, Ill.; Lewis B. Thomas, Bloomington, Ill.; A. W. Young, re-elected, Alton, Ill.; —— Davis, Jacksonville, Ill.; R. J. Barr, Joliet, Ill.; George Aischuler, Aurora, Ill.; James A. Patton, Evanston, Ill.; J. R. Oughton, Dwight, Ill.; E. C. Jewett, Woodstock, Ill.; William F. Bryan, Peoria, Ill.; C. H. Wilson, Washington, Ia; John C. B. Briggs, Nevada, Ia.; Mahlon M. Head, Jefferson, Ia.; J. E. Wilson, Perry, Ia.; J. H. Strubel, Toledo, Ia.; S. C. Huber, Tama, Ia.; J. H. Stubenrauch, Pella, Ia.; Frank Long, Newton, Ia.; P. M. Plumb, re-elected, Marion, Ia.; Charles H. Finch, Ft. Madison, Ia.; W. A. Callen, re-elected, Centerville, Ia.; —— Ross, Indianola, Ia.; J. J. Shell, Boone, Ia.; S. A. Steadman, Manchester, Ia.; G. W. Alexander, Chariton, Ia.; W. A. Jackler, Anamosa, Ia.; E. M. Evans, re-elected, Vinton, Ia.; Eugene Shaffter, Eagle Grove, Ia.; W. B. Murray, Fairfield, Ia.; F. K. Stebbins, re-elected, Iowa City, Ia.; Anson Barstow, Oakland, Cal.; W. H. Roe, Kearney, Neb.; F. A. Edwards, Webster City, Minn.; Carter H. Harrison, re-elected, Chicago, Ill.; —— Covert, Evansville, Ind:; —— Reefy, Lorain, O.; —— Fletcher, Chippewa Falls, Wis.

Personal Notes.

E. S. Bryant has been elected city engineer at Berlin, N. H.

F. C. Turner has been appointed city engineer at Oakland, Cal.

Stephen J. Bussell has been appointed city engineer at Oldtown, Me.

Philip H. Coombs has been elected city engineer at Bangor, Me.

Charles W. Campbell has been appointed city engineer at St. Joseph, Mo.

George W. Tonson was elected city engineer at Toledo, O., April 15.

Cyrus T. Long has been re-elected borough engineer at Greensburg, Pa.

John Meehan has been elected street commissioner at Chippewa Falls, Wis.

Samuel Zirkle has been appointed superintendent of waterworks at Luray, Va.

Adna Dobson, city engineer of Lincoln, Neb., has been appointed state engineer.

Lewis F. Prevost, city engineer at Lima, O., died suddenly of heart disease April 12.

L. J. Wagner has resigned his position as superintendent of water works at Rome, N. Y.

Clarke B. Collins of Johnstown, Pa., has been elected borough engineer at New Florence, Pa.

J. N. Hazlehurst of New Orleans, La., has been elected engineer for the proposed street paving in Mobile, Ala.

Charles Wallanger has been elected superintendent of the city water works at Harriman, Tenn., to succeed P. A. Knapp, resigned.

John J. Molter has been elected mayor, A. M. Wagner city clerk and John W. Miller city engineer at Sandusky, O.

Hiram Phillips, M. Am. Soc. C. E., has been elected president of the board of public improvements at St. Louis, Mo.

George C. Wimberly has been re-elected city engineer at El Paso, Tex. Mr. Wimberly has held this office since April, 1894.

Carl Bedell, assistant city engineer at Nebraska City, Neb., has been appointed electrician of the electric light company of that city.

G. L. Jones has been elected president, Dr. Baumhardt vice-president, and Mr. Neilson secretary of the water works board at Lorain, O.

Daniel R. Walker has resigned his position as chief of the electrical bureau at Philadelphia, Pa., after forty-five years of continuous service.

Frank H. Martin has been appointed a member of the water board at Springfield, Mass., to succeed Henry F. Moriarity, whose term expired Jan. 1.

Frank L. Marston, former city engineer of Bangor, Me., has established an office in the Bass building in that city, where he will practice civil engineering.

Charles M. Gray has been elected president, A. N. Russell, secretary, and John V. Schmidt treasurer of the board of water commissioners at Ilion, N. Y.

E. W. Buckley has been elected city engineer, W. F. Reed superintendent of water works, and George Houston water commissioner at Kalamazoo, Mich.

F. W. Dalrymple, Assoc. M. Am. Soc., C. E., has resigned as city engineer at Hornellsville, N. Y., and has been appointed city engineer at Jamestown, N. Y.

Robert Cochran Bacon, formerly chief engineer and superintendent of water works at Jersey City, N. J., died at his home in East Orange April 12, aged eighty-three years.

Lewis M. Hastings has been elected city engineer for the thirteenth time at Cambridge, Mass. George Howland Cox has been appointed park commissioner for three years.

Frank N. Kindolf has severed his connection with the Standard Sewer Pipe company of Rochester, N. Y., to become general manager of the American Sewer Pipe company of Pittsburg.

F. T. Sherman of the Long Island City Refinery works, New York, succeeds G. R. Wilton in the management of the local branch of the Alcatraz Asphalt Paving company at Spokane, Wash.

Thomas Herbert Minshall, electrical engineer of Croydon, England, and Charles H. Merz, consulting engineer of London, are investigating electric light and street railway properties in America.

Rudolph Hering, M. Am. Soc. C. E., and Geo. W. Fuller, Assoc. M. Am. Soc. C. E., have formed a partnership as consulting engineers, and will have offices, after May 1, at 100 William-st., New York City.

W. K. Eldridge has resigned his office as city engineer of Lafayette, Ind., and has become associated with S. H. Brubaker & Co., architects and engineers, Stevenson Bldg., Indianapolis, Ind. G. H. Stevenson has been appointed city engineer of Lafayette.

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C. H. Reynolds has been appointed city engineer and W. L. Pray superintendent of water works at Ft. Dodge, Ia.

James Ritchie, chief city engineer at Cleveland, O., has resigned to accept the position of consulting engineer to the grade crossing commission. The position of city engineer has been offered to Walter P. Rice, ex-director of public works, who has taken the matter under consideration.

J. W. Bradley, Assoc. M. Inst. C. E., has been appointed city engineer at Westminster, London. For the last six years Mr. Bradley has been borough engineer of Wolverhampton, was on the staff of the borough engineer of Burnley for six years, and prior to his appointment at Wolverhampton was borough engineer of Nelson.

Michael J. Sampson, formerly auditor of the water assessment bureau at Chicago, was confined in the penitentiary at Joliet, Ill., April 10, on a charge of forgery. The final imprisonment of Sampson ends one of the most remarkable fights for liberty ever made by a convicted man in the Illinois courts. His attorney exhausted every resource of law, with one exception—that of appealing to the United States Supreme court.

Charles M. Darling, formerly of the firm of Byrne & Darling, civil engineers of White Plains, New York., has formed a partnership with his brother, Oscar Darling, C. E. of Babylon, N. Y., and will establish an office about May 1 in Mineola, N. Y., with branch offices in Hicksville and Amityville. The firm name will be Charles M. Darling & Bro., and they will practice consulting work and surveying.

Richard Pennefather Rothwell, editor of the Engineering and Mining Journal and of The Mineral Industry, died at his home in New York City, April 17, of cancer of the stomach, aged sixty-five years. Mr. Rothwell was born in Ingersoll, Ontario, Canada. He graduated from the Rensselaer Polytechnic Institute, at Troy, N. Y., as civil engineer in 1858, and from the Ecole Centrale des Mines, at Paris, as engineer of mines, in 1862. In 1871 he united with Eckley B. Coxe and Martin Coryell in organizing the American Institute of Mining Engineers, of which he was unanimously elected president in 1882. In January, 1874, he became an editor, and afterwards owner of the Engineering and Mining Journal, and has edited the Mineral Industry since its beginning nine years ago.

MACHINERY AND TRADE.

New Automobile Street Sweeper.

The Automobile Street Sweeping Company, 185 Summer-st., Boston, Mass., has developed a new machine, now ready for the market, which cleans gutters, sweeps the street, loads the sweepings and sprinkles ahead of the brooms with condensed steam. There are three floors or decks on which dust receptacles can be stored, including a roof which can be extended to any reasonable extent. The machine may be used independently for sprinkling and sweeping. It is said to show no steam nor dust. Being an automobile there are no horses, and when the loading devices are employed it takes the place of three pairs of horses, drivers and outfits.

The company also makes a gutter sweeper which is very effective. A photograph of one at the head of a row of sweepers is shown in one of the illustrations to an article on Cambridge, Mass., Street Work in this number, and the article contains a short statement of the work the machine is doing.

Analyses of Trinidad Asphalt Manufacturing Company's Product.

The Trinidad Asphalt Manufacturing company of St. Louis, Mo., has received an analysis of their product from Prof. A. W. Dow, engineer commissioner, Washington, D. C., which shows the following: Their D. asphalt paving cement contains 99.10 per cent. of bitumen soluble in carbon bisulphide; 0.45 per cent. organic matter not bitumen, and 0.36 per cent. silica and clay; their G liquid asphalt contains 99.68 per cent. bitumen soluble in carbon bisulphide; 0.12 per cent. organic matter not bitumen and 0.20 per cent. silica and clay. The report also states that none of the samples were appreciably altered by being kept at 300 degrees for six hours in an open vessel, and that the cement is of the right consistency to make a good paving material; that it is adhesive and elastic. The report says: "These samples are superior to any I have ever examined in physical properties, and rank among the better asphalts for paving purposes. A combination of D paving cement and your G liquid asphalt will produce a most splendid article."

The company has recently completed a new refinery at 320 to 324 S. Twenty-first-st., which is equipped with the best and latest appliances. The company does not belong to the trust.

Trade Publications.

The Castalia Portland Cement Company of Pittsburg, Pa., with works at Castalia, O., has just issued an attractive pamphlet descriptive of its Tiger brand of Portland cement and the works at which it is made. Excellent reproductions of photographs show views of the works, the rotary kiln

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and powdered coal fuel apparatus, as well as many views of buildings, arches, streets, walks, platforms, etc., in which their cement has been used. The company evidently has nothing to conceal and is proud of its plant, for it says: "We would be glad at any time to have our friends visit our works and would take great pleasure in showing them through what we consider to be the best equipped cement plant in the United States."

The Trials of Contractors is the title of a little illustrated pamphlet issued by the Brinley-Hardy company of Louisville, Ky., showing the advantages of their road plows, light and heavy, ranging from ninety-two pounds to 450 pounds. The saving in repairs by the use of these plows is the point which the writer emphasizes.

Recent Inventions.

669,512. March 12, 1901. Street Sweeper, Edward S. Day, Worcester, Mass. A sweeper of the rotary-brush, endless-carrier type arranged to be attached to the rear of a wagon so as to discharge the dirt therein.

669,682. March 12, 1901. Garbage Furnace, Frank Gorman, Toledo, O. The garbage is discharge upon a rotary annular grate and means is provided for separating the liquids from the solids and spraying the liquids into the furnace.

669,683, 669,684. March 12, 1901. Street Sweepers, John T. Collins, Hartford, Conn., assignor one-half to W. L. Curtiss, same place. Self-propelling sweepers of the rotary-brush type.

670,074. March 19, 1901. System of Sewer Ventilation and Disinfection. George P. Heilman, Evansville, Ind. Each inlet conduit is provided at its surface end with a normally closed-valved liquid inlet, and a normally open fresh air inlet, and circulation is intermittingly obtained by a suction appliance connected to the main sewer.

670,222. March 19, 1901. Concrete-Mixer. Howard Campbell, Brooklyn, N. Y. A chute provided with peculiar deflecting means for insuring a proper mixture of material which is poured through the chute.

670,478. March 26, 1901. Fireproof Construction. Franklin W. Garrettson, Baltimore, Md. A metallic plate is secured to the plaster-supporting means in contact with the inner portions of the plaster. Concrete is then supported on the plate.

670,570. March 26, 1901. Bridge. Willis F. Walker, Charlestown, W. Va. A roadway or walk for bridges composed of I beams having wider lower flanges and a filling of asphalt or cement between and on top of the beams.

670,707. March 26, 1901. Wall Construction. Willis H. Fisher and Claude Brouse, San Francisco, Cal. Composite slab composed of concrete with a metallic tube embedded therein so as to receive dowels for uniting adjacent slabs.

670,778. March 26, 1901. Construction of Tunnels for Sewers. Ossian Guthrie, Chicago, Ill. The method consists in widening a river or canal at the point of intersection with the proposed sewer; sinking a tube or shell transversely of the river at the widened portion; then filling in the widened portion so as to bury the ends of the tube, and finally tunneling to the ends of the shell.

670,926. April 2, 1901. Street Sweeping Machine, Arthur Cameron, Chicago, Ill., assignor to Frederick C. Austin, same place. A gutter sweeper having a peculiar means for supporting the brush which rotates about a substantially vertical axis.

670,968. April 2, 1901. Road Cleaning Machine, Henry J. Ranger, Christ church, New Zealand. A somewhat complicated machine, utilizing brushes about the size of hand brushes.

671,133. April 2, 1901. Rigid Suspension Bridge, Albert V. H. L. Gisclard, Vincennes, France. A three-hinged suspension truss with the end hinges in the body of the truss and the contour the envelop of the curves of force passing through the three hinges.

671,280. April 2, 1901. Street Sweeper, Joaquin Jene, Buenos Ayres, Argentina. A sweeper of the rotary-brush endless-carrier type, with a low-down receiver and a hoist for raising the receiver and dumping into a wagon.

671,340. April 2, 1901. Combined Fire Wagon and Asphalt Mixture Heater, Robert Hooke, Chattanooga, Tenn. A combined tool heating wagon and reheater for asphalt paving.

671,353. April 2, 1901. Method for treating sewage, Robert H. Reeves, London, England. The method consists in spraying unslaked lime with water under high pressure; mixing the lime water with the sewage to precipitate the solid matter, and then treating the effluent liquid with manganate of soda and sulphuric acid.

671,492. April 9, 1901. Apparatus for purifying water, Hans Reisert, Cologne, Germany. A peculiar arrangement of tanks for treating water with milk of lime.

671,596. April 9, 1901. Fire-proof construction, Abraham H. L. Himmelwright, New York, N. Y., assignor to New Jersey Wire Cloth company, Trenton, N. J. The joists are composed of metallic bars extending from beam to beam and arranged edgewise vertically with a downward bend between the beams, the joists being embedded in concrete.

671,679. April 9, 1901. Fire-proof construction, William Orr, Trenton, N. J., assignor to New Jersey Wire Cloth company. The adjacent edges of the reticulated metal sheets are provided with strengthening bars woven into the sheet, and metal spanners are then clamped about the adjacent strengthening bars.

671,686. April 9, 1901. Means for utilizing space in crowded municipalities, Hyppolyte Bergeron, Longue, Canada. An elevated structure supporting tramways is built in the center of thoroughfares and surrounded by buildings of any desired character.

671,777. April, 1901. Self-locking Fire hose bridge, John E. Ryan, Minneapolis, Minn.

671,923. April 9, 1901. Bridge superstructure, Richard Peterson, Elberfeld, Germany. A central tubular main truss is composed of two horizontal main girders and two vertical main girders having their chords in common, and brackets extending laterally beyond the respective main gird-

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ers, with a roadway carried by each of the brackets.

Trade Notes.

ASPHALT.

The purchase of an asphalt repair plant is again recommended by Mayor Cunbe of St. Joseph, Mo., in his annual message to the council.

The Western Construction company has been incorporated at Indianapolis, Ind., by Henry W. Marshall as president, S. T. Murdock, vice-president, and Charles M. Murdock, secretary and treasurer, all of Lafayette, Ind. The new company has organized for the purpose of contracting asphalt and other pavements and municipal contracting generally. Mr. Marshall was formerly president of the Western Payinig and Supply company, and the Messrs. Murdock are connected with the Bermudez Asphalt Paving company. The new company will open an office in Indianapolis in the near future, and will enter into competition for the construction of the local street improvements.

BRICK.

The Graves Shale Brick company, about five miles from Birmingham, Ala., which has been in operation since March 1, contemplates making vitrified brick later on. The plant is owned by Capt. W. H. Graves, with H. S. Matthews as general manager and R. T. Kyle as superintendent.

The Mayfield Vitrified Brick company of Graves county, Ky., has been incorporated and will open general offices in Frankfort; capital stock, $20,000.

The Galesburg Paving Brick company, Galesburg, Ill., has elected officers as follows: President and manager, Jas. Bloomfield, Galesburg; secretary and treasurer, W. C. Terry, Galesburg. It was decided at the annual meeting to improve the works, and new kilns and dryers will be constructed.

The St. Louis Vitrified Brick and Firebrick company, St. Louis, Mo., has been incorporated by F. C. Pauley, W. C. Hanley and John P. McMenamy; capital stock, $75,000.

H. Weil & Bros. have established a plant at Goldsboro, N. C., for the manufacture of vitrified paving brick.

R. E. Causey, Thomaston, Ga., desires catalogues, prices, etc., from manufacturers of brick, tile and sewer pipe machinery.

The Jewettsville Pressed Brick and Paving companay of Buffalo, N. Y., has purchased the plant of Brush & Schmidt, and will manufacture paving and other brick. Wm. C. and Wm. H. Warren, H. and Stephen C. Brush will control and manage the company.

The Hickory Run Brick company, Hickory Run, Pa., has been organized by C. A. Dorney, F. Butz and I. D. and S. N. Weaver, to manufacture brick, tile, sewer pipe, etc.

The Greencastle Brick and Tile company, Greencastle, Ind., has been incorporated by Charles S. Eitleberg, Robert L. Higert, George W. Pence, George Hathaway and James L. Randel.

The Virginia Paving Brick company, Chilhowie, Va., has been incorporated to manufacture brick, by G. E. Price, H. B. Smith, H. B. Thompson, H. L. Flournoy and R. S. Spillman of Charleston, W. Va.

A deposit of shale has been discovered by Fred Roth near St. Joseph, Mo., and a company has been formed to manufacture paving brick, roofing tile and drain tile.

A. E. Lain and D. W. Ballou are interested in a new pressed and virtrified brick plant at Hennessey, Ok. T.

W. H. Miller and S. B. Wright, Martinsburg, W. Va., have formed a partnership under the firm name of Miller & Wright for the purpose of manufacturing dry press and paving blocks, Waynesboro, Pa.

The St. Louis Vitrified and Fire Brick company, St. Louis, Mo., have been incorporated and a plant is being erected at Clayton, near St. Louis, which will be ready for business by June 1.

CEMENT.

The Clifford Lime and Stone company, Cartersville, Ga., contemplates purchasing the equipment of a cement plant of 500 to 600 barrels daily capacity.

The establishment of a new cement plant at Durham, Ont., Canada, is contemplated, according to press reports.

The Krause Cement company, Martin's Creek, Pa., has begun to build its plant, which was burned recently.

The Dexter Portland Cement company, Nazareth, Pa., will increase its bonded indebtedness, May 1, from $60,000 to $200,000, and its capital stock from $300,000 to $625,000. The capacity of the plant will also be increased to 2,000 barrels a day.

The German Portland Cement company, Detroit, Mich., has been incorporated by Milton D. Bryce and John W. Smith of Detroit and H. A. Clapp of Cripple Creek, Col. The company will operate cement works in St. Joseph county, Mich.

The Indiana Portland Cement company, which was organized to erect two Portland cement plants—one at Milltown, Harrison county, and the other at Milford, Kosclusko county—will have its main offices in Indianapolis. V. O. Foulk of Detroit, Mich., is secretary of the company. Edwin T. Allen, one of the directors, stated recently that if present plans are realized work on the buildings for the plants will be commenced within four months. A large tract of land has recently been purchased at Milltown and a plant with a capacity of 3,500 barrels a day is proposed.

F. L. Smidth & Co., New York City, have received a contract for equipping the plant of the Iroquois Portland Cement company, at Caledonia, N. Y., with Davidsen patent tube mills.

The Kinderhook Portland Cement company, recently organized under the laws of West Virginia to manufacture Portland cement in northern Indiana and southern Michigan, will open offices in Indianapolis shortly. The marl lands of the company are located near Kinderhook, Mich., and Fremont, Ind.

HOT WATER HEATING PLANTS.

The proposition to grant a twenty-five year franchise to N. P. Hyatt and others for establishing a heating plant to carry steam and gas to all parts of Webster City, Minn., has been favorably voted. The plant will cost about $50,000.

The Home Heating and Lighting company of Indianapolis has awarded a contract to

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Fred C. Smock for constructing the new power plant at Sixteenth and Alabama-sts. The building will be three stories, sixty-four by one hundred feet, and will cost about $8,000. Contracts have been let for most of the materials to be used in the system of heating and lighting to be installed.

The city council of Goshen, Ind., refused a franchise April 22, for a municipal hot water heating plant.

The Chillicothe Hot Water Heating company, Chillicothe, O., has been incorporated by Joseph A. Meyers, W. A. Story, Dr. J. H. Lash, M. Kramer and H. E. Holland. The company has applied for a franchise and will begin the work of putting in the plant as soon as it is granted.

LIGHTING

The Fox River Valley Gas and Electric company has been incorporated to furnish gas, electricity, steam heat and hot water to the residents of Neenah, Menasha, Green Bay and Kaukauna, Wis., together with the towns and villages in Brown, Calumet, Winnebago and Outagamie counties. The central plant will be located at Appleton, Wis. The incorporators are James H. Jenkins, Thomas A. Rockwell and David M. Cameron of Oshkosh.

The Gas Arc Light company of the United States, New York City, has been incorporated by J. W. McCrea, C. G. Macy and F. G. W. Sigrist of New York City.

The Oxygen Light and Fuel company has been incorporated under the laws of Delaware, and the general offices will probably be located in East Liverpool, O. The purpose of the company is to manufacture a gas for fuel and lighting purposes. The capital stock is $5,000,000. Frank B. Felt of Chicago is the promoter of the enterprise.

The Hampton Roads Investment and Improvement company has been incorporated with a capital stock of $75,000 to manufacture gas and electricity for lighting and power, and will establish a little town between Hampton and Newport News, Va.

Newly incorporated companies: Montgomery Light and Water Improvement company, Montgomery, W. Va.; Riverside Power company, Riverside, Cal.; Conneaut Lake Electric Manufacturing company, Conneaut Lake, Pa.; International Electric company, Jersey City, N. J.; Bloomfield Light, Power and Heat company, Bloomfield, Ind.

SEWER PIPE.

The Ogden Sewer Pipe & Clay company, Ogden, Utah, has been incorporated to manufacture drain tile, sewer pipe, water pipe, brick and other clay products. Jas. Harris is president.

MISCELLANEOUS.

The Morava Construction company, Chicago, Ill., has begun the erection of a plant to be devoted to the manufacture of bridges and steel frame work It will cost $15,000.

The Domestic Garbage Burner company was incorporated at Salt Lake City, Utah, March 26, with the following officers: President, John W. Donnellan; vice-president and general manager, H. M. Clay; secretary, H. W. Doscher; treasurer, Frank E. McGurrin. The new method of disposing of house garbage is said to consist of an automatic attachment with a piece of the stovepipe from the kitchen range, which carbonizes the debris, no matter how wet, and makes it ready to be used as fuel.

The Pittsburg (Pa.) Seamless Bottle company have awarded contracts to William B. Scaife & Sons, of that city, to design, manufacture and erect the buildings for their glass factory at Everson, Pa. Among the larger structures are the main factory building, mixing rooms, Lehr building, boiler and engine houses. Steel frame construction is to be used throughout.

The Canada Purifying company, limited, Windsor, Ont., has been incorporated to contract for, construct and operate water treatment sewage purification, garbage, heat, light and power works. The incorporators are J. E. Row, William Revell and John Sale.

A company is being formed for the purpose of uniting all the stone quarries in western New York producing Medina block paving stone. The trust will have a capital of $1,500,000. The new firm will control the output of the Medina block pavement in use in Eastern cities. The western part of Monroe county has about fifteen quarries, Orleans county about forty, which with several in other counties makes a total of about seventy-five. The prime movers in the new combination are John J. Ryan of Medina and Michael Slack, owner of one of the largest quarries in the state. A Mr. Chapman of the firm of Moore & Schley, New York bankers, and E. R. Jones of New York are interested.

William B. Scaife & Sons, Pittsburg, Pa., have received a contract from Spang, Chalfant & Co., for extensive additions to their Etna tube works. A number of large steel buildings covered with corrugated iron will be erected, involving a heavy tonnage of structural material.

The street committee of Columbus, Wis., has been instructed to purchase a stone crusher of the Austin & Western Co.

R. G. Parmley & Bro., Sioux Falls, S. D., have begun the manufacture of cement sidewalks.

A. L. Schultz has been appointed manager of the newly-organized Pittsburg district of the American Bridge company with C. W. Bryan as engineer in charge of constructing and chairman of the board, and Richard Kuehn, jr., M. Am. Soc. C. E., Chief Engineer. This district includes the Keystone branch, Mr. J. W. Walker, M. Am. Soc. C. E., Manager, Mr. J. K. Lyons, M. Am. Soc. C. E., Engineer; New Columbus branch, Mr. W. N. Cleveland, Manager, Mr. J. Braune, Assoc. M. Am. Soc. C. E., Engineer; Pittsburg branch, Mr. J. W. Walker, M. Am. Soc. C. E., Manager, Mr. J. G. Spielman, Assoc. M. Am. Soc. C. E., Engineer; Shiffler branch, Mr. J. W. Walker, Manager; Mr. P. Bryn, Engineer; Youngstown branch, Mr. E. M. Scofield, Assoc. M. Am. Soc. C. E., Manager and Engineer; Wrought Iron Works branch, Mr. John R. Reed, Manager, Mr. R. X. Basford, Engineer. Mr. L. J. Affelder, Jun. Am. Soc. C. E., is Contracting Engineer in Charge of Structural Contracting, and Mr. A. J. List, Assistant Mechanical Engineer.

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IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Madison, Ind.—The Jefferson county council has appropriated $85,000 to purchase the pike roads. The owners of the roads ask $96,000 for them.

Cambridge, Mass.—The superintendent of streets and the committee on roads and bridges of Lowell, Mass., visited this city April 8 to examine the vitrified brick paving and the working of the street department.

Kokomo, Ind.—A suit will be tried in June on street improvement bonds amounting to $10,000, in which 300 citizens will be made defendants. The suits, which are being prepared by Farson, Leach & Co., bankers of Chicago, are brought under a recent supreme court decision, holding that property-owners are liable, even though the value of the land benefited is less than the cost of the improvement.

Buffalo, N. Y.—The residents of Main and Genesee-sts. will bring actions under the recent decision of the court of appeals in the eight-hour law to test the validity of assessment rolls for paving three streets.

CONTEMPLATED WORK.

Webster City, Ia.—A boulevard is proposed.

Shenandoah, Ia.—Street paving is suggested by the press.

Peoria, Ill.—Brick paving is proposed for University place.

Ft. Scott, Ark.—Brick paving is desired for Judson-st.

Wahpeton, N. D.—Dakota-ave. will be paved.

Boise, Idaho—Paving is proposed for a number of streets.

Clarinda, Ia.—Paving is contemplated for the public square.

Iowa City, Ia.—Paving is contemplated for College-st.

Montclair, N. J.—This town voted $16,000 for hard roads.

Findlay, O.—Second-st. will be paved with vitrified brick this summer.

Everett, Mass.—The sum of $25,000 has been appropriated for new brick walks.

Hamilton, O.—Ordinances have been passed for paving S. B-st. and Ross-ave.

Red Oak, Ia.—The question of paving is being considered. Mayor Griffith.

Topsham, Me.—The council has decided to purchase a stone crusher.

Gainesville, Fla.—The residents of this city desire brick paving.

Dexter, Wis.—This town voted to purchase a new stone crusher.

Wells, Minn.—The question of street paving is being revived.

Cambridge, N. Y.—The question of paving Main-st. is being considered.

Willoughby, O.—This town will issue $10,000 street improvement bonds.

New Martinsville, W. Va.—This town voted to issue bonds for street improvements.

Camden, N. J.—The question of paving Mt. Ephraim-ave. with asphalt is being considered.

Beloit, Wis.—The question of paving Broad-st. with brick is being considered.

Iowa City, Ia.—A resolution has been passed to pave College-st. with brick. Mayor Stebbins.

Lima, O.—Brick and block asphalt paving is proposed for W. High-st. C. E. Lynch, cy. clk.

Walpole, Mass.—The council has decided to expend $5,000 on concrete walks this year.

Danville, Ill.—The question of concrete sidewalks is being considered. Mayor Bailey.

Irwin, Pa.—The borough council decided April 4 to pave the principal street this summer.

Albert Lea, Minn.—The council committee has recommended paving with brick or asphalt blocks during 1902.

Houston, Tex.—This city voted to issue $300,000 bonds for street improvements and sewers.

Brookline, Mass.—The question of constructing a new boulevard is being considered.

Versailles, Ind.—The question of constructing macadam roads will be voted on May 3. Robt. R. White, co. audt.

Sharon, Pa.—Paving, sidewalks and sewers are contemplated for Sharpsville-st. Joseph Riddle, pres. com.

Binghamton, N. Y.—Resolutions are pending for paving Eldridge-st. and Prospect-ave. with brick.

Wells, Minn.—The council is urged by the press to consider the question of street paving.

Milwaukee, Wis.—E. Water-st., between Erie and Buffalo-sts., will be paved this year with brick or granite.

Madison, Wis.—The council has ordered Johnson-st., from Warren to Bruce, macadamized and guttered.

Brooklyn, N. Y.—Resolutions have been passed to repave Hatsey, Marion and Chauncey-sts. with asphalt.

Denver, Col.—The extension of the asphalt paving of Colfax-ave., from St. Paul-st. to Colorado boulevard, eight blocks.

Sioux City, Ia.—Resolutions have been passed for paving Third, Jones, Jennings, Virginia, Court and Iowa-sts.

Meriden, Conn.—The council has appropriated $15,000 for the purpose of paving State-st. with asphalt.

Kewanee, Ill.—A petition has been circulated asking for two-course brick paving in S. Tremont-st.

Houston, Tex.—Plans have been submitted for paving Tenth, Dart, Holly and Edwards-sts. Cy. Engr. Miller.

Chelsea, Mass.—The question of appropriating $15,500 for street improvements is being considered.

White Plains, N. Y.—The board of trustees have ordered an issue of $100,000 bonds for macadamizing the village streets.

Ft. Wayne, Ind.—Resolutions have been passed for paving Barr and Jefferson-sts. and Masterson-ave.

Dayton, O.—(Special.)—F. M. Turner, cy. engr., says 6,500 sq. yds. of brick paving on 6-in. concrete is contemplated.

Johnstown, Pa.—Ordinances have been introduced for paving Pine, Horner, Short, Hudson, Union, Lincoln and a number of other streets.

Plainfield, N. J.—The street and sewer committee will ask for an appropriation for $26,000 for street and sewer improvements.

Leadville, Col.—The property-owners in W. Eighth-st. have petitioned for grading and will probably construct sidewalks.

Chippewa Falls, Wis.—Mayor Fletcher

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recommends the purchase of a rock crusher and the macadamizing of the streets.

La Crosse, Wis.—The residents of West-ave. are in favor of macadamizing that street from La Crosse to Green Bay. Mayor Anderson.

New Martinsville, W. Va.—Plans and specifications are being prepared for brick paving. W. G. Alexander, cy. engr.

Moline, Ill.—Hearings on petitions for paving will begin early in May. Mayor Wessel is in favor of 25-ft. boulevards for residence streets.

Albia, Ia.—Petitions are being circulated asking that the city council pave S. Main-st., from the public square to the bridge over the C., B. & I.

Louisville, Ky.—The new specifications for asphalt reconstruction provide that the city shall lay concrete ready for the asphalt. Chmn. Grainger.

San Francisco, Cal.—Supervisor Curtis has suggested the issue of $1,000,000 bonds for the purpose of improving the accepted streets of this city.

Charleston, S. C.—About 6,000 sq. yds. of macadam pavement by day labor, and drains to cost about $5,000, are contemplated. J. H. Dingle, cy. surv.

Burlington, Ia.—A resolution has been adopted authorizing the city engineer to advertise for bids for paving Fourth and Washington-sts. Mayor Marquardt.

Glens Falls, N. Y.—City Engineer Slade has been directed to prepare estimates for paving South, Warren, Bay and Glens-sts.

Denver, Col.—The board of public works has asked for an appropriation of $10,000 for paving several triangles with asphalt.

Kearney, Neb.—Ordinances have been passed for constructing brick or cement walks. B. O. Hostetler, mayor; H. J. Hull, cy. clk.

Longport, N. J.—An ordinance has been approved for constructing flag, brick, asphalt, cement or wood sidewalks. R. M. Elliott, mayor.

Davenport, Ia.—A resolution has been passed providing for the paving of Fifth-st., from Perry to Western-ave. Thomas Murray, cy. engr.

Bloomington, Ill.—A petition is being circulated for paving Lee-st., from Front to Empire. Paving is proposed between the city and Normal.

Atlanta, Ga.—Plans have been prepared for grading and paving Whitehall-st. with asphalt. Estimated cost $48,125. R. M. Clayton, cy. engr.

Geneva, N. Y.—The board of public works decided April 18 to pave with tar macadam Lake, Geneva, State, North, Center, William and Toledo-sts.

Chicago, Ill.—An ordinance is being prepared providing for paving Arch-st. with asphalt. Geo. K. Wheelock, cy. engr.

Ware, Mass.—Appropriations for street work this year have been made as follows: Highways, $5,500; paving Main-st., $4,500; sidewalks, $1,500.

Gowanda, N. Y.—The broad of trade has submitted a petition to the village trustees asking them to secure estimates for paving the principal streets.

Topeka, Kas.—Resolutions were adopted April 5 for paving Tyler, Quincy and Monroe and other streets with brick on sand foundation. J. H. Squires, cy. clk.

Warren, Pa.—This town voted April 16 to issue $25,000 bonds for paving and curbing Pennsylvania-ave. E. H. Beshlin, cy. clk.

Portland, Or.—The purchase of a steam road roller, at a cost of $3,500, is recommended by Wm. B. Chase, cy. engr., in his report to the council.

Canton, O.—Bids will be asked about the middle of May for over 2-mls. of vitrified block paving and about the first of June for 2-mls. of graveling, curb and flag walks.

Great Falls, Mont.—A report has been adopted providing for the creation of a special improvement district for boulevarding Second-st., between Sixth and Fifteenth-sts.

Nashville, Tenn.—Appropriations are being considered for the following: Paving public square with brick, $23,500; paving First-st. with granite, $8,000. W. M. Leftwich, cy. engr.

Omaha, Neb.—The board of public works has been instructed to obtain propositions for repairing the asphalt pavements on Sixteenth, Cummings and Douglass-sts.

New York City—A macadam roadway 100 feet wide and one and one-half miles long, to connect Claremont with Audubon park, is proposed. Andrew E. Foye, ch. engr. dept .

Kalamazoo, Mich.—The residents on W. Main and S. Burdick-sts. desire asphalt block paving on three thoroughfares. The need of paving in Portage and Water-sts. is also urged.

Troy, N. Y.—The council contemplates the construction of 3,600 feet of brick paving on Oakwood-ave. and 3,000 feet of block paving on Ferry-st. E. R. Cary, cy. engr.

St. Paul, Minn.—A petition has been submitted to the board of public works asking that Eighth-st., between Wabasha and Broadway, be paved with asphalt blocks.

Topeka, Kas.—A petition will be circulated for paving Buchanan-st., from Twelfth to Fifteenth. City Engineer Wise is of the opinion that about thirty-five blocks of streets will be paved this year.

Seattle, Wash.—(Special)—A. H. Dimock, asst. cy. engr., says that 47,000 sq. yds. of asphalt and 18,000 sq. yds. of brick paving on 4 to 6-in. concrete is contemplated. The time for receiving bids has not been set.

Morgantown, W. Va.—A plan for macadamizing the leading county thoroughfares and streets of this city, at an estimated cost of $150,000, is being considered by the city council.

Athens, Ga.—(Special)—J. W. Barrett, cy. engr., says that 8,500 sq. ydr. of granite and 33,000 sq. yds. of macadam paving is contemplated. The work will be done under the direction of the city engineer.

Deadwood, S. D.—(Special.)—D. A. McPherson says that this city contemplates laying about one mile of brick street paving this season of the best material and most approved construction. Sol Star, mayor.

Meriden, Conn.—Bids will be asked for constructing about 3,500 sq. yds. of asphalt paving on State-st. as soon as the plans are completed; estimated cost, $10,000. W. S. Clark, cy. engr.

Chicago, Ill.—The construction of an asphalt road across the campus of the University of Chicago, from Fifty-seventh to Fifty-ninth-sts., and on Fifty-ninth-st., between Ellis and Lexington-aves., is contemplated.

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Frankfort, Ind.—Plans have ben prepared by City Engineer Cheney for paving W. Clinton-st., with brick on concrete foundation. A petition is being circulated asking that S. Jackson-st. be paved with asphalt.

Denver, Col.—Petitions will be submitted to the board of public works asking that several new paving districts be created on Capitol Hill. Macadam will be used in paving these streets.

Elmira, N. Y.—The city engineer has been directed to ask for bids for asphalt paving on Baldwin and W. Water-sts. and Madison-ave.; brick paving on Market and Lake-sts., Medina blocks on Nicks-st., 7,000 ft. Medina curb.

New Haven, Conn.—The committee on streets decided April 10 to recommend alluvial clay vitrified brick pavement for Congress-ave., from George to Oak, and crushed stone paving for Orchard, Vernon, Lamberton Ferry, Baldwin and other streets and avenues.

Troy, N. Y.—A resolution has been favorably reported which provides for vitrified brick or block paving, with 16-in. curb, on Oakwood-ave. A resolution has been adopted for paving Ferry-st. with granite blocks with a 20-in. curb.

Orange, N. J.—Ordinances have been prepared providing for the macadamizing and guttering of Snyder-st. Petitions have been referred to the street committee for macadamizing and curbing Essex-ave. and flagging Tremont-ave.

Bowling Green, O.—Plans and specifications for the improvement of Main and Wooster-sts. have been prepared by the city engineer. The work will include 11,633 sq. yds. of paving on new foundation, 54,368-sq. yds. resurfacing, curbing, etc.

Portsmouth, N. H.—A. F. Howard of this city, Wm. H. C. Follansbey of Exeter and Warren Brown of Hampton Falls have been appointed a committee to take charge of the work of continuing the construction of the Ocean highway along the seacoast.

Cedar Rapids, Ia.—The city council has decided to pave as follows: Asphalt—Fourth, Sixth, S. Second, Eighth, Tenth and Twelfth-sts. and Eastlake-place. Brick—First and Second-aves. and an alley. Macadam—Sixth and Thirteenth-sts. and Sixteenth-ave.

Springfield, Mass.—(Special.)—Chas. M. Slocum, cy. engr., says appropriations have been recommended as follows: $53,000 for paving, $53,000 for macadamizing and gravelling, $50,000 for general maintenance and repair. The city may purchase a road roller.

Terre Haute, Ind.—The city engineer's plans and specifications for improving Fourteenth and a Half street, from Chestnut to Sycamore, have been approved and bids will be asked soon. A petition has been filed for building concrete sidewalks and stone curbing on N. Eighth-st., from Wabash-ave. to the Vandalia railroad.

East St. Louis, Ill.—Petitions have been presented to the city council asking that Main-st., between Broadway-st. and Missouri-ave., be paved with asphalt and that Rock road, from Tenth to the Belt railway, a distance of one mile, be paved with asphalt, with 6-ft. granitoid walks on each side of the road.

Minneapolis, Minn.—The council paving committee has ordered paving as follows: Sixth-st., brick; Eighth-st., cedar blocks on concrete, with brick gutters; Washington-ave., N., from Twentieth to Twenty-fourth, sandstone, and from Twenty-fourth to Twenty-sixth, granite; Seventh-st., S. E. State, macadam; Tenth-st., brick; Marshall-st., N. E., limestone macadam.

Cincinnati, O.—Plans and specifications will be prepared for paving Logan and Elder-sts. with brick; Findlay-st. with granite and Green-st. with asphalt. These improvements are to be made under the act authorizing the issue of $100,000 in bonds for street improvements with brick, granite or asphalt. Plans and specifications were ordered for paving Campbell-st. with brick under the general improvement laws.

Indianapolis, Ind.—Ordinances have been passed for paving as follows: Asphalt, West-st., from North to Fourteenth-st; Cora-st., from Illinois-st. to Capitol-ave. Gravel, portions of Dorman, New York, St. Clair, Nevada, Linden, Palmer and Rural-sts. and Temple and Parkway-aves. Creosoted wood blocks, New York-st., from Noble to C., C., C. & St. L. railroad tracks. Cement walks, portions of Spruce, Belmont, Dorman, Twenty-third, Twenty-fifth, Meridian, Sixteenth, Tenth, Dearborn, Illinois, Lambert, Nelson and Thirteenth-sts., and Senate, Arsenal and Capitol-aves. Petitions have been filed for asphalt paving in Kentucky-ave., from Merrill-st. to White river; Louisiana-st., from Illinois to Capitol-ave.; Union-st., from Merrill to McCarty. Block paving and curbing on Tenth-st., from West-st. to the Canal. The city contemplates experimenting with novaculite for repairing Sixteenth-st., from Alabama-st., east. If the material proves satisfactory it will be used in paving other streets. A new 4-inch surface will be put on Sixteenth-st. Albert Sahm, chairman B. P. W.

CONTRACTS TO BE LET.

Washington, N. J.—Bids are asked until May 4 for constructing a macadam road. A. W. Cutler, dir. bd. chosen freeholders.

Gloversville, N. Y.—Sealed bids are asked until May 6 for 3,800 sq. yds. of asphalt block paving. C. Fiske, jr., cy. engr.

St. Paul, Minn.—Bids are asked until May 6 for grading Lexington-ave. Matt Jensen, cy. clk.

Cincinnati, O.—Sealed bids are asked until May 4 for improving Sheed road, from Hanley road to Blue Rock pike. E. L. Lewis, co. audt.

St. Mary's, O.—Sealed bids are asked until May 4 for 7,000 sq. yds. of brick paving. J. H. Rowe, jr., vil. clk.

Greensburg, Pa.—Bids are asked until May 6 for 2,523 ft. of brick paving on W. Pittsburg-st. John S. Bell, burgess; I. C. Snyder, clerk.

Hacketts:own, N. J.—Bids are asked until May 4 for constructing a country road. A. W. Cutter, dir. bd. freeholders.

Decatur, Ind.—Bids are asked until May 22 for constructing macadam roads. Abe Boch, co. audt.

Cincinnati, O.—Sealed bids are asked until May 9 for paving McCullough-st., from Eastern-ave. to Dumont-st., with brick. Robt. Allison, prest. B. P. S.

Springfield, O.—Sealed bids are asked until May 3 for about 16,000 sq. yds. of brick or block paving on Clifton-st. Wm. Sharon, cy. engr.; R. N. Lantz, cy. clk.

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Paterson, N. J.—Sealed bids are asked until May 3 for paving Main, Market, Marshall and Washington-sts. with asphalt. John T. Brett, st. commr.; H. J. Harder, cy. engr.

Devil's Lake, N. D.—Sealed bids are asked until May 6 for constructing a grade at Pelican Point. Wm. H. Brown, mayor.

Elizabeth, N. J.—Sealed bids are asked until May 7 for grading a street requiring 29,200 cu. yds. of earth excavation, and 1,600 lin. ft. of curb reset. J. L. Barth, cy. engr.

New York City—Sealed bids are asked until May 2 for regulating and grading portions of Bronx and Pelham parkways. Dept. Parks.

Washington, D. C.—Bids are asked until May 4 for about 100,000 cu. yds. of grading on certain streets and avenues. H. B. F. MacFarland, chm. dist. comls.

Windsor, Ont., Canada.—Bids are asked until May 3 for 60,000 sq. ft. of concrete walks. Stephen Lusted, cy. clk.

Spartanburg, S. C.—Sealed bids are asked until May 4 for 15,000 sq. yds. of granite block and 13,000 sq. yds. of brick paving. F. H. Knox, cy. engr.

Bloomington, Ind.—Sealed bids are asked until May 7 for constructing gravel roads in Ellettsville and Modesto, Gosport and Mt. Tabor. Samuel M. Kerr, co. audt.

VanWert, O.—Sealed bids are asked until May 6 for constructing about 6 mls. of gravel or stone road in Dustman road district, Pleasant twp. C. F. Manship, clk. Pleasant twp., Van Wert.

Columbia City, Ind.—Sealed bids are asked until May 7 for 20,105 sq. yds. of brick paving on Van Buren-st., 13,685 sq. yds. on Line-st., 11,713 sq. yds. on Chauncey-st. Benj. T. Menaugh, mayor; A. N. Miller, cy. engr.

Toledo, O.—Sealed bids are asked until May 13 for paving South-st., from Dix to Summer, with vitrified brick or block, Kreodone creosoted blocks or asphalt blocks. J. E. Connell, cy. clk.

Bessemer, Ala.—Sealed bids are asked until May 7 for grading, curbing and sidewalks on a number of streets, requiring 17,000 ft. of 5-in. granite curb, 2,000 cu. yds. earth excavation, and 3,000 cu. yds. chert. E. L. Mitchell, cy. clk.

Millvale, Pa.—Sealed bids are asked until May 7 for paving, grading and sewering Evergreen-ave., from North to Findlay-st., with vitrified brick. Edw. B. W. P. Fischner, burgess; C. W. Dankmeyer, clk.

St. Louis, Mo.—Sealed bids are asked until May 10 for reconstructing 12 streets with brick on concrete base, and four streets with granite block on concrete base. Robt. E. McMath, pres. B. P. I.

Chicago, Ill.—Bids are asked until May 10 for constructing roads and paths in the post cemetery at Ft. Sheridan. Col. E. B. Atwood, Ch. I. M.

Newark, N. J.—Sealed bids are asked until May 7 for 47,000 sq. yds. of brick and asphalt paving and 12,254 sq. yds. of granite block paving. Ernst Adam, cy. engr.

Seattle, Wash.—Sealed bids are asked until May 18 for constructing 47,200 sq. yds. of asphalt paving, 8,600 sq. yds. of brick gutters and 30,500 ft. of concrete curb. R. H. Thomson, cy. engr.

Akron, O.—Sealed bids are asked until May 4 for furnishing paving cement for brick pavement for the year ending April 1, 1901. Wm. A. Durand, clk. bo. cy. com's.

Havana, Cuba—Sealed bids are being asked until May 29 (postponed from April 3) for street paving. Lieut. W. J. Barden, corps of engrs., U. S. A., chief engineer, city of Havana; Alejandro Rodrigues, mayor.

Michigan City, Ind.—Sealed bids are asked until May 13 for 44,000 sq. yds. of brick paving, 340 ft. of 12 in. sewer and 30 sq. yds. of cement sidewalk approaches. H. M. Miles, cy. engr.

Pottsville, Pa.—Sealed bids are asked until May 7 for curbing, guttering and sidewalks during the coming year and for furnishing broken stone. G. A. Berner, town clk.

Rockville, Ind.—Sealed bids will be received until May 4 on six new sections of levee, according to plans and specifications of John T. Campbell, C. E., on file with him. The work includes 7 mls. of grading. Bids received on sections or as a whole. Lyford Pike and Levee assoc. of Parke Co., John T. Campbell, C. E.

Crawfordsville, Ind.—Sealed bids will be received until May 6 for 177 ft. of grading and graveling in an alley. Sealed bids are asked until May 20 for 295 ft. of vitrified brick paving on concrete on Main-st.; grading and graveling Burford-st. and an alley. Constructing cement walks on Water, Main, E. Main, Market and Washington-st. E. S. Simpson, cy. engr.

CONTRACTS AWARDED.

Kenton, O.—The contract for paving was awarded to C. B. Hall & Co. of Findlay, O., for $14,000.

Spokane, Wash.—The Alcatraz Paving company secured the contract for paving Washington-st. for $23,545.

Findlay, O.—C. B. Hall & Son submitted the lowest bid April 20 for paving N. Cory-st. with brick.

San Rafael, Cal.—The contract for macadamizing Tiburon boulevard has been awarded to E. Schwiesan for $5,495.

New Albany, Ind.—The Barber Asphalt Paving company was awarded the contract for paving Pearl-st., from Spring to Oak.

East Pittsburg, Pa.—Contract for paving and sewering this town was awarded April 15 to Cronan & O'Hara for $48,000.

Lynchburg, Va.—The contract for paving Madison-st. with vitrified brick was awarded to Dean & Payne at $1.29 a sq. yd.

Lima, O.—Spyker, Milligan & O'Brien submitted the lowest bid for paving E. McKibben-st. with asphalt, at $23,763.

Glenville, O.—The contract for paving Doan-st. with asphalt was awarded April 17 to the Trinidad Asphalt Paving company of Cleveland.

Grand Rapids, Mich.—The contract for paving N. Iowa alley with brick has been awarded to Hauser, Owen & Ames for $1,.949.

Franklin, La.—E. A. Grasser of New Orleans was awarded the contract, April 8, for paving the streets of this city, for $15,247.50.

Rochester, N. Y.—The contract for paving Portland-ave. with trap rock has been awarded to H. N. Cowles, of this city, for $52,614.

Camden, N. J.—The contract for building

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a macadam road, from Haddinsfield to Greenland, has been awarded to J. F. Shanley of Newark for $14,000.

Trenton, N. J.—A contract for 15,000 sq. yds. of asphalt paving in this city has been awarded to the Interstate Paving company of Utica, N. Y.

Des Moines, Ia.—Magden & Sheley secured the contract, April 12, for 4,331 sq. yds. of brick paving on broken stone foundation, at $1.4616 a sq. yd.

Canton, O.—(Special)—The contract for paving Mulberry-st. was awarded to Wm. S. Hadley, for $3,750, and for W. Fourth-st. to Wise & McCafferty for $4,373.

Bristol, Tenn.—The Virginia Paving Brick company was awarded the contract April 5 for paving Main-st., with brick, at $1.56 a sq. yd., and for the back streets at $1.35.

Worcester, Mass.—The Webb Granite and Construction company secured the contract for furnishing this city with granite curbing, paving blocks, etc., during the ensuing year for $30,000.

Rome, N. Y.—Asphalt paving contracts have been awarded as follows: N. Washington-st., Warner-Quinlan Asphalt company, of Syracuse, $24,013.60; N. George-st., International Paving company, $30,920.04.

Seattle, Wash.—(Special)—A. H. Dimock, asst. cy. engr., says the contract for improving Yesler, May and other streets, involving 24,000 sq. yds., was awarded to F. McLellan for $107,102.

Newton, Ia.—The contract for brick paving was awarded, April 8, to J. H. Killman of Des Moines, as follows: Excavating, 30 cents a cu. yd.; overhaul, 2 cents; paving, $1.53 a sq. yd.; curbing, $34.62 a lin. ft.

St. Joseph, Mo.—The Barber Asphalt Paving company was awarded a contract, April 11, for repairing Sixth-st., from Patee to Olive, at $1.85 a sq. yd. The street is to be paved under the Haynes law, and over the protest of the property-owners.

Louisville, Ky.—Bids were received April 19 for asphalt reconstruction, the prices ranging from $1.85 to $2.25 a square yard. The bids were submitted by R. D. Park & Co., Logan County Asphalt company, Barber Asphalt Paving company, Green River Asphalt company.

Erie, Pa.—Bids were received April 15 for repairing and keeping in repair certain asphalt pavements for a period of ten years, as follows: Cleveland Trinidad Paving company., Cleveland, O., $5,775 per year; Inter State Paving company, Utica, N. Y., $5,980; Warren Scharf Asphalt Paving company, New York City, $5,845; Henry Mayer, Sr., Erie, Pa., $6,100; Mayer Bros., Erie, Pa., $5,046. (This proposition does not comply with the provisions of the ordinance authorizing the work.) The contract implies the resurfacing of the entire 42,052 sq. yds. within the next ten years.

Philadelphia, Pa.—Paving contracts were awarded April 11 as follows: Repairing with asphalt—Pennsylvania Asphalt company, 40 streets, $2.59 to $2.64 a sq. yd.; Richardson & Ross, 40 streets, $2.60; Vulcanite Paving company, 66 streets, $2.57 to $2.64. Asphalt paving—Alcatraz Paving company, 60 streets, $2.38; Pennsylvania Asphalt company, 12 streets at $2.37 to $2.41, and 12 streets at $2.52 to $2.56; Richardson & Ross, 7 streets, $2.37 to $2.41, and 4 streets, $2.50: Vulcanite Paving company, 25 streets, $2.35 to $2.68, and 16 streets, $2.56 to $2.61. Vitrified brick or block—T. Cunningham, 19 streets, $1.90 to $2.35; David McMahon, 3 streets, $2.07 to $2.09; D. J. McNichol, $1.97 to $2.07. Repaving with vitrified brick or block—T. Cunningham, 22 streets, $2.01 to $2.64; D. J. McNichol, 3 streets, $2.03 to $2.07; David McMahon 1 street, $2.10. Repaving with granite blocks—T. Cunningham, 2 streets, $3.02 and $3.05; D. J. McNichol, 13 streets, $2.54 to $2.57. Paving B St. with granite blocks—D. J. McNichol, $2.54. This work will involve nearly $1,000,000. Warner & Quinlan submitted bids for new paving and resurfacing with asphalt, but Director Haddock could not consider them because the company failed to comply with the specifications in furnishing the necessary samples to the highway bureau.

Baltimore, Md.—The contract for paving College and Maryland-aves. and Prince George and King George-sts. with vitrified brick and a number of smaller streets with rubble and cobblestones was awarded April 11 to Geo. and Jos. Jewell for $38,000.

Spokane, Wash.—Bids were received April 8 for paving Washington-st. with asphalt as follows: City Street Improvement company, San Francisco, Cal., paving, $24,203; maintenance, $2,300; Alcatraz Asphalt company, Los Angeles, Cal., paving, $23,945; maintenance, $2,300.

Columbus, O.—The contract for paving Indiana-ave., between Fourteenth and Fifteenth-sts., with Nelsonville brick with cement filler was awarded April 15 to N. B. Abbot for $2,450.50. A. G. Pugh secured the contract for setting the curb on Syracuse-st., from Lathrop-st. to Parsons-ave., for $886.70.

Seattle, Wash.—The contract for cement walks on Seventeenth-ave. was awarded to T. Ryan & Co. for $15,641. The Moore Investment company awarded a contract April 6 to Stanley & Son for opening two mls. of streets in the Capitol Hill tract involving the removal of 60,000 cu. yds. of earth, for from $12,000 to $15,000.

Bay City, Mich.—Bids were submitted April 10 for paving Midland-st., from Center to Euclid-ave. The Ayres Asphalt Paving company of Zanesville, O., submitted the lowest bid on asphalt, $1.191 a sq. yd., including 6-in. concrete, and Campbell & Osborn were the lowest bidders on paving brick, at $1.64, including 6-in. concrete base. The bids were referred.

St. Joseph, Mo.—The contract for grading and macadamizing Fourth-st., from Cedar to Hayes's addition, was awarded April 5 to Heisley Bros. as follows: Macadamizing, $7,25 per 100 superficial ft.; brick gutters, $1.35 a sq. yd.; cross guttering, $1.25 a sq. yd.; cross walks, $1.25 a lin. ft.; sidewalks, 75 cents a sq. yd.; curbing, 45 cents a ft.; grading, 19 cents a cu. yd.

Minneapolis, Minn.—The Galesburg Paving Brick company, Galesburg, Ill., was awarded the contract for furnishing this city with paving brick at 91 cents a sq. yd., and $1.20 for special sizes. Other contracts for furnishing supplies were awarded as follows: A. F. Thompson, crushed slate, $3.15 cu. yd.; Minnesota Sandstone company, sandstone curb, 44, 46 and 49 cents, according to size required; Menominee Pressed Brick

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company, Portland cement, $1.89 per bbl., and natural cement, 83 cents per bbl.; Arnold Granite company of St. Cloud, rough granite paving blocks, $1.44½, and dressed blocks, $1.69 a sq. yd.

Chicago, Ill.—(Special)—The R. F. Conway company, Chamber of Commerce bldg., Chicago, was awarded the contract April 16 for repairing asphalt streets in this city for the period ending Dec. 31, 1901, at $1.42 a sq. yd. for wearing surface only and $2.12 a sq. yd. for wearing surface including concrete. The Barber Asphalt company of New York City bid $1.49 and $2.89, respectively.

Erie, Pa.—Bids were received April 15 for resurfacing asphalt pavements on portions of Eleventh, Eighth, Twelfth, Sassafras and Fifth-sts., including ten-year repair contract, as follows: Trinidad Paving company, Cleveland, O., $5,775 per year; Interstate Paving company, Utica, N. Y., $5,960; Warren-Scharf Asphalt Paving company, New York City, $5,845.27; Henry Mayer, sr., Erie, $6.100. Action was deferred. Bids were also received for paving Peach-st., from Twenty-sixth to the southern city limits, with brick, as follows:

Geo. H. Kraft—Park wire cut No. 1, $1.69½ cents per square yard; Mack wire cut No. 1 paver, $1.80; Porter wire cut No. 1 paver, $1.75.

V. D. Eichenlaub—No. 1 wire cut brick, $1.82; Mack wire cut No. 1, $2; Porter wire cut No. 1, $1.90; Advance wire cut No. 1, $1.88.

John McCormick & Son—Park wire cut fire clay, Mack wire cut fire clay, Porter wire cut, Advance wire cut, Canton shale, $1.92 per square yard each.

Mayer Bros.—Jamestown shale No. 1, $1.79 a square yard; Park No. 1, $1.85; Advance No. 1, $1.85; Canton iron block, repressed, $1.85; Canton No. 1 wire cut block, $1.83.

Wilkesbarre, Pa.—The contract for paving St. Clements-st., with brick, has been awarded to Gibbons & Co. of this city, at $1.96 a sq. yd. for Mack repressed block.

St. Paul, Minn.—The R. F. Conway company of Chicago was awarded the contract for paving Rice-st., as follows: From College-ave. to University-ave., $22,285 for city's portion, 10,516 sq. yds., and $5,647 for railroad portion, 2,567 sq. yds.; total, $27,932. From University-ave. to Como-ave., $6,689 for city's portion, 2,958 sq. yds., and $5,581 for railroad portion, 2,537 sq. yds.; total, $12,270. The total bids of the Barber Asphalt company on these sections was $33,581.84 and $14,114.21 respectively. Bids were received March 28 for paving Rice-st., from Como-ave. to Front-st., as follows: Barber Asphalt Paving company, $40,864.40; R. F. Conway company, $46,151. This work includes the following: Asphalt paving, 16,345 sq. yds.; brick paving, 1,320 sq. yds.; curb stone, 7,155 lin. ft.; excavating, 3,193 cu. yds.

SEWERS.

Oberlin, O.—The annual report of W. B. Gerrish, city engineer, states than $380 was required for operating expenses for the sewage farm during 1900. The farm cost $2,490, and is now receiving about 80,000 gals. of sewage daily.

The New Jersey State Sewerage Commission on April 2 considered plans for making surveys and securing estimates of the cost of each of the systems of sewage disposal which might be adopted by the municipalities in the Passaic valley.

CONTEMPLATED WORK.

Hampton, Ia.—A sewerage system is proposed.

Madison, Mo.—A sewerage system is contemplated.

Pendleton, Ore.—A sewerage system is proposed.

Brownwood, Tex.—A sewerage system is proposed.

Oskaloosa, Ia.—A better system of sewage is urged.

New Florence, Pa.—A sewerage system is contemplated.

Jackson, La.—The storm sewerage system is inadequate.

South Haven, Mich.—A sewer in district No. 3 is proposed.

Boone, Ia.—A sewage system is proposed for the Fifth ward.

Hammond, Ind.—A sewer is proposed for May-st. Mayor Reilley.

Oakcliff, Tex.—A company is being organized to build a sewerage system.

Monroe, La.—Bids will be asked soon for building a sewerage system.

Sherman, Tex.—This city voted to issue $80,000 bonds for a sewerage system.

South Brooklyn, O.—This town voted to issue $30,000 bonds for building sewers.

Newton, Mass.—The board of aldermen have decided to issue $20,000 bonds for new sewers.

Oskosh, Wis.—A trunk sewer is urged for Murdock and Jackson-sts.

Sharon, Pa.—The question of building a sewerage system is being agitated.

Toronto, Ont.—The construction of a storm overflow sewer on Wallace-ave. is urged.

Mt. Carmel, Pa.—The question of issuing bonds for a sewerage system is being considered.

Delaware, O.—A resolution has been passed to contract a sewerage system at a cost of $72,714.

Pittsfield, Mass.—Bids for building the proposed sewage disposal plant will be asked soon.

Rockwell, Ia.—The town council is considering the question of building a sewerage system.

Woodbury, N. J.—Plans for a swerage system, to cost $55,000, will be made by Geo. Pfeiffer, of Camden.

Covington, Ind.—Plans for sewers are being prepared by Chas. Cottingham, C. E., of Danville, Ill.

Chico, Cal.—The question of issuing $40,000 bonds for a sewerage system will be voted on in May.

Dayton, O.—(Special).—F. M. Turner, cy. engr., says 36 miles of sanitary sewers are contemplated.

Bangor, Me.—Surveys and estimates for a trunk sewer for the Bakerville district have been proposed.

Washington, Pa.—The borough of East Washington voted to issue $20,000 bonds for a sewerage system.

Eureka, Cal.—Plans and estimates for a sewerage system have been adopted; estimated cost, $85,000.

Florence, Ala.—About $5,000 will be ex-

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pended for a storm water sewer at the west end of Tennessee-st.

Winona, Minn.—Plans for a storm water sewerage system have been prepared by City Engineer Miller.

Moorestown, Pa.—A petition is being circulated providing for the issue of $30,000 bonds for a sewerage system.

Bayfield, Wis.—The town board will borrow $5,000 for the purpose of repairing and extending the sewerage system.

Jackson, O.—Plans for a sewerage system and purifying works have been approved by the state board of health.

Seattle, Wash.—(Special)—A. H. Dimock, asst. cy. engr., says about 2-mis. of lateral sewers are contemplated.

Sandusky, O.—The plans for a sewerage system for this city have been approved by the state board of health.

Hartford, Conn.—City Engineer Bond has been directed to prepare a plan for a sewer in Blue Hills-ave. and Harrison-st.

Bozeman, Mont.—The council has approved the plans of S. H. Crooks, C. E. of Livingston, Mont., for a new sewerage system.

Shelton, Conn.—The borough engineer has been instructed to prepare plans for a system of sewers for the South End.

Merced, Cal.—The city contemplates building about 12-mis. of 6 to 12-in. pipe sewers. H. H. Henderson, cy, engr.

Sumpter, Ore.—Surveys are being made preparatory to constructing a sewerage system in the business portion of town.

Bennington Center, Vt.—Surveys for the proposed sewerage system will be made by Garnett D. Baltimore of Troy, N. Y.

Meadville, Pa.—Plans have been prepared for 2,200-ft. of 24 to 10-in. pipe sewers on State-st. W. A. Doane, cy. engr.

New Decatur, Ala.—Surveys are being made preparatory to making plans for the proposed sewerage system. M. A. McCalla, cy. engr.

Binghamton, N. Y.—(Special.)—Henry Ward says that bids are being asked for a sewer in Griswold-st., 3,000 ft. long, to cost about $12,000.

Charlevoix, Mich.—Plans for about 2,775 ft. of 6 to 15-in. sewer in Main-st. have been contemplated. J. M. Eaton, chmn. sewer com.

Troy, N. Y.—The construction of 3,000 ft. of 30x45-in. brick sewer in Ferry-st. is contemplated. E. R. Cary, cy, engr.

Utica, N. Y.—The city engineer has been directed to prepare plans and specifications for a trunk sewer through Water and other streets.

San Francisco, Cal.—The board of public works has asked for an appropriation of $221,000 for building new sewers. C. E. Grunsky, cy. eng.

Lebanon, Ind.—Plans and specifications for a sewerage system for this city are being made by C. G. H. Goss of Martinsville, Ind.

Wauwatosa, Wis.—The common council decided, April 10, to build 4 mis. of sewers and a sewage disposal plant at a total cost of $35,000.

Worcester, Mass.—The construction of the east main carrier of the intercepting sewer system has been decided upon; estimated cost, $79,129.

Uniontown, Pa.—The borough engineer has been authorized to prepare plans and specifications for sewers at Berkley and E. Main-sts.

Terrell, Tex.—The formation of a company to build a sewerage system in this city is contemplated by M. C. Kelly of Gainesville.

Vincennes, Ind.—Plans and specifications for a complete sewerage system for this city have been prepared by Charles C. Brown, C. E. of Indianapolis.

Westfield, Mass.—A special committee has been appointed to investigate the question of issuing $60,000 bonds for building sewers in the southern part of town.

Janesville, Wis.—(Special)—C. V. Kerch, cy. engr., says the question of constructing a general sewerage system was carried by a large majority April 2.

Petaluma, Cal.—(Special)—The board of trustees passed a resolution to construct 1,350 ft. of 12 in. and 300 ft. of 6 in. sewer in B-st. N. S. Frost, cy. engr.

Sault Ste. Marie, Mich.—Plans for a sewerage system will be prepared by Willis Chipman of Toronto, Ont. The question of building the system will be voted on in May.

Holyoke, Mass.—(Special)—James L. Tighe, cy, engr., says that about 3,000 ft. of main sewers are contemplated, although there is no appropriation for the work as yet.

Findlay, O.—Contracts will probably be awarded in July for building a brick sewer in Liberty-st., and a pipe sewer in Elm and Sandusky-sts. John W. S. Riegle, cy. engr.

Athens, Ga.—(Special)—J. W. Barnett, cy. engr., says that sewer extensions, to cost about $30,000, are contemplated. The work will be done under the direction of the city engineer.

Canton, O.—(Special)—A sewerage system, including 8 mis. of sanitary sewers, is contemplated for district No. 1. Bids will be asked by June 1 for over 3 mis. of sanitary sewers.

Washington, D. C.—The district commissioners have ordered the construction of a sewer on a portion of Connecticut-ave. at a cost of $11,382, and a sewer through Waggaman tract at a cost of $5,445.

Minneapolis, Minn.—The committee on sewers will recommend the construction of the remaining section of the east main carrier of the separating sewage system, and for sewers in a large number of streets.

Springfield, Mass.—(Special)—Charles M. Slocum, cy. engr., says the sewer committee contemplates the expenditure of about $65,000 for trunk sewers and about $40,000 for lateral sewers and ordinary repairs. Most of this work will be done by day labor.

Fond du Lac, Wis.—(Special)—Bids will soon be received for intercepting sewers, a sewage pumping station of about 5,000,000 gallons daily capacity, septic tanks and bacterial contact beds. The sewage pumps will be driven by electric power. The disposal plant will have a capacity of 750,000 to 1,000,000 gallons daily. F. B. Hoskins, mayor. Plans are being prepared by George S. Pierson, Mem. Am. Soc. C. E., Kalamazoo, Mich.

CONTRACTS TO BE LET.

Dunkirk, N. Y.—Sealed bids will be received until May 7 for a sewer. Cy. clk.

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Kenton, O.—Sealed tenders are asked until May 15 for a sewerage system. F. E. Ray, secy.

Wilkesbarre, Pa.—Bids are asked until May 11 for brick or stone sewers. F. Deitrick, cy. clk.

Tampa, Fla.—Sealed bids are asked until June 30 for 2,350 ft. of 8 and 4-in. pipe sewers. W. B. Henderson, prest. B. P. W.

St. Paul, Minn.—Sealed bids were asked until May 6 for furnishing 1,650 ft. of 12-in. sewer pipe. Matt Gensen.

San Francisco, Cal.—Sealed bids are asked until May 6 for constructing a sewerage system at Fort Point, Cal. J. M. Marshall, Q. M.

Chester, Pa.—Sealed bids are asked until May 6 for constructing the Fourth-st. sewer. Frank W. Harrison, cy. clk.

Algona, Ia.—Bids are asked until May 11 for digging the uncompleted portions of public drain No. 1. M. P. Weaver, co. audt.

Canton, O.—Sealed bids are asked until May 4 for extending the Cassidy-st. storm water sewer. Phil H. Weber, cy. engr.

Toledo, O.—Sealed bids are asked until May 13 for constructing pipe sewers in certain alleys. J. C. Connell, cy. clk.

Crawfordsville, Ind.—Sealed bids are asked until May 20 for a system of sewers in numerous streets. E. S. Simpson, engr.

Perry, N. Y.—Bids are asked until May 6 for constructing a sewerage system consisting of 10 mls. of pipe sewers. Thos. H. Bussey, prest. bd. trustees.

Akron, O.—The work of construction of the Barberton Ditch in Barberton, O., will be sold at public outcry, May 11, in this city. J. A. Sisler, co. audt.

Pipestone, Minn.—Seals bids will be received until May 2 for building a sewerage system at the Pipestone school, Pipestone, Minn. W. A. Jones, com'r Indian affairs, Washington, D. C.

Washington, D. C.—Sealed bids are asked until May 6 for a sewerage system at the Southern Ute agency. W. A. Jones, com'r. Indian Affairs, Washington, D. C.

New Orleans, La.—Bids will be received July 3 for the completion of the Third-st. system, the St. Bernard system, the Nashville system, the Algiers system and the Lowerline system. Bd. Drainage com'r.

Havana, Cuba—Sealed bids will be received until May 29, (postponed from April 3), for a sewerage system. Lieut. W. J. Borden, corps of engrs., U. S. A., ch. engr., Havana; Alejandro Rodriquez, mayor.

Kenton, O.—Sealed bids are asked until May 7 for building sewers in North Kenton sewer district No. 1 with necessary outfall sewer and a disposal plant. W. E. Meyers, cy. engr.; John P. Dugan, cy. clk.

Boston, Mass.—Bids are asked until May 13 for constructing section 49, and culverts and embankments for sections 48 and 49, requiring 2,000 ft. of 135x150-in. sewer, with 325 ft. of 48 and 30-in. culverts, and 180,000 cu. yds. of filling. W. M. Brown, ch. engr. Met. Water & Sewerage Bd.

CONTRACTS AWARDED.

New Ross, Ind.—The contract for constructing a sewer on Main-st. was awarded to Wm. Mason.

Connellsville, Pa.—The contract for 12 mls. of sewer was awarded to J. B. Sheets & Co. of Pittsburg for $62,500.

Tacoma, Wash.—The contract for a new sewer in dist. No. 115 was awarded, April 16, to Mitchell & Co. for $5,837.50.

Cincinnati, O.—Thomas P. Strack secured the contract for the Bloody Run sewer for $48,119.

Helena, Ark.—The contract for a sewerage system was awarded, April 3, to Guild & Co. of Chattanooga, Tenn., for $55,132.

Hanford, Cal.—The contract for constructing a sewerage system was awarded to W. D. Trewhitt for $16,200.

Burlington, N. J.—A franchise for constructing a sewerage system, including 10 mls. of 8 to 20-in. sewers, has been granted Geo. Pfeiffer of Camden for $75,000.

Connellsville, Pa.—The contract for constructing 12½ mls. of pipe sewers, with 160 manholes, has been awarded to J. B. Sheets & Co. of Pittsburg for $52,970.

Des Moines, Ia.—The contract for building sewers in Buchanan-ave. and Twenty-eighth-st. was awarded, April 12, to O. P. Herrick at 93 4-5 cents a lin. ft.

Hartford, Conn.—The contract for building sewers in Orange and Arbor-sts. and the Boulevard was awarded, April 10, to the Hartford Paving and Construction company for $4,496.90.

Dedham, Mass.—The lowest bids received for constructing a sewerage system were as follows: Newman Construction company, Providence, R. I., section B $29,350, C $21,620, E $10,218, total $61,188; Frank A. Gammino, Providence, R. I., section A $11,201, D $6,525, total $17,726. There were 17 bidders on the work.

Little Rock, Ark.—The contract for constructing sewers in district No. 28 has been awarded to J. H. McCoppin of this city, as follows: 5,400 ft. 10-in. pipe at 98 cts.; 3,600 ft. 8-in. pipe at 61 cts.; 13,000 ft. 6-in. at 61 cts.; 56 manholes at $37; 16 flush tanks at $82; concrete at $6, and lumber at $15. The trench to average 10 ft. in depth.

Cohoes, N. Y.—William Stanton secured contracts, April 15, for sewers, as follows: Clinton-st., $481.25; Imperial-ave., $212.21; Lancaster-st., $312.53; New-st., $262.80; alley between Hudson and Maple-aves., $1,593.32; alley between Forest and Maple-aves., $3,862.79.

Newark, N. J. (Special).—Ernest Adam, engr. of dept. of streets and sewers, says that the contract for constructing the Central relief sewer was awarded, April 11, to B. J. Sullivan, 200 Broadway, New York, for $10,687.50.

New York City.—Bids were received April 17 for constructing a sewer in Broadway, borough of Queens, and for a sewage disposal plant in connection with the same. The bids, which include brick sewer, circular brick sewer, vitrified pipe sewer, 65 manholes, timber, work, concrete, etc., are as follows: Nassau Construction company, Brooklyn, N. Y., $222,688; P. F. Brennan, 721 E. 180th-st., $212,038. Each company bid $124,000 for the disposal plant, which is included in the above figures.

Cleveland, O.—Bids for sewers were received as follows: Axtell-st., John Potts & Co., $2,996; Trot-st., C. T. McCracken & Co., $4,701; Woodland Hills-ave., William Eggers, $5,845; Union-st., Beers & Doolittle, $1,615; Adelphia-st., C. F. Kuentz, $3,573; Cable-st., C. F. Kuentz, $3,414; East-ave., Reaugh Construction company, $2,671; Finn-

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st., C. F. Kuentz, $2,831; Marble-st., Campbell Bros., $1,481; Sawyer-st., William J. Townsend, $2,627; Canal-st., C. F. Kuentz, $4,732; Frederick-st., William Lehman, $3,381; Lenox-st., Christian Burkhardt, $9,105; Marcelline-ave., Reaugh Construction company, $12,378; Parkview-ave., C. T. McCracken & Co., $1,689; Regent-st., Christian Burkhardt, $1,601; Robinson-ave., C. T. McCracken & Co., $1,328; Rockland-ave., Campbell Bros., $1,198; Rural-st., John Potts & Co., $2,958; Wright-st., Christian Burkhardt, $2,465.

WATER-WORKS.

Yonkers, N. Y.—The annual report for 1900 shows that on 4,968 services 4,852 water meters are used.

Belleville, N. J.—An ordinance increasing the water rates, to take effect May 1, passed two readings at a meeting of the Belleville township committee April 2.

Leavenworth, Kas.—The Leavenworth Water company will appeal to the United States Supreme court from the decision of the Kansas Supreme court requiring it to make annual statements of business to the city clerk.

Newtown, (L. I.) N. Y.—The Citizens' Water company of this city has absorbed the Wyckoff Heights Water company, a corporation supplying Wyckoff Heights with water, and will connect the mains of the two systems.

East Albany, N. Y.—James M. Caird, chemist and bacteriologist of Troy, N. Y., has been retained by the East Albany Water company of this city to conduct a series of chemical and bacteriological tests at their new filter plant.

Racine, Wis.—The water supply in the entire southern part of the First ward was cut off recently on account of the 14-in. water mains of the Racine Water company giving out. When examined it was found that electrolysis had completely ruined the pipe.

Jeffersonville, Ind.—Frank Schefold of New Albany is making an investigation of the water works system of this city, preliminary to the cancelling of the contract between the city and the water company It is claimed that the report will show that the company has but 9 mls. of mains, while the contract calls for 10 mls., and that the company is not living up to its agreement regarding the pumping capacity of its plant.

CONTEMPLATED WORK.

Jacobs, Wis.—Surveys are being made for water works.

La Crosse, Wis.—A fund of $8,000 has been set aside for meters.

Cedar Falls, Wis.—A new water tank to cost $18,000 is contemplated.

Winona, Minn.—This city voted to extend the water works system.

Russell, Mass.—A water works system will probably be built by private parties.

Boise, Idaho.—The question of municipal water works will be voted on.

Webster, S. D.—Bonds for a water works system for fire protection have been approved.

Yankton, S. D.—The Business Men's club is urging the necessity of a water works system.

Evansville, Ind.—A new filter plant is contemplated by the water board. Trustees Grote and Brentano.

Seattle, Wash.—The question of extending the water mains of this city is being agitated.

Angelica, N. Y.—This city voted April 16 to expend $1,000 for water works repairs.

Redlands, Cal.—The question of purchasing the water works system will be voted on.

Marlboro, N. Y.—The Marlboro Water company contemplates improving the water works.

Lockport, N. Y.—The common council and taxpayers approved the $75,000 water supply act April 2.

Norristown, Pa.—Mains will probably be laid to Newcastle. A. E. H. Smith and W. J. Wilson interested.

Leon, Ia.,—Bids will probably be received about May 15 for laying 2,200 ft. of 4-in. mains, a pump, etc.

Greenwood, Ind.—This town voted April 4 to allow a company to build water works and electric light plant.

Rome, N. Y.—The board of water and sewer comns. have decided to call a special election to vote on the question of procuring a gravity water supply from Fish creek at a cost of $152,000.

Auburn, N. Y.—The water commissioners contemplate laying about 15,000 ft. of 6, 8 and 12-in. water mains this year.

Granite Falls, Minn.—This town voted to raise $6,000 bonds for extending their water works and electric light plant.

Marion, O.—The Marion Water company contemplates improving its works, including pumping machinery, etc. E. H. Cowan, mgr.

Green Bay, Wis.—The Green Bay Light and Power company contemplates between one and two miles of water mains extension. Mayor Mainland.

Sellersburg, Ind.—A committee has been appointed to secure information regarding water works. Frank Williams, secy. com.

Kansas City, Mo.—A resolution was adopted April 19 for constructing a 30-in. water main from Kaw point to Genesee-st.

Shreveport, La.—The council has demanded that the owners of the water works take steps at once to improve the water supply.

Northampton, Mass.—The water commissioners decided, April 16, to establish a new water supply system, at a cost of $300,000.

Lewiston, Idaho—The council will consider, May 6, the proposition of William H. Skinner for a twenty-five-year franchise for a water works system.

Sherman Heights, Tenn.—J. M. Stephens desires estimates for water works to supply this place and East Chattanooga, according to press reports.

Moline, Ill.—The water works system will be improved by the addition of water mains and a mechanical filter. D. W. Mead, cons. engr., Chicago. Mayor Wessel.

Pittsburg, Pa.—Plans for the proposed filter plant have been completed, and bids will be asked soon; estimated cost, $2,500,000. Geo. W. Wilson, dir, pub. wks.

Jasper, Minn.—Plans have been adopted for a water works system, and the question of issuing bonds will be voted on soon. S. B. Howe, engr. Sioux Falls, S. D.

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Houston, Tex.—This city proposes to install new boilers with new wells for an increased water supply and otherwise improving the works of the Houston Water Works company.

Grand Rapids, Mich.—A resolution was adopted April 5 authorizing the city engineer to prepare plans and specifications for the improvement of the city water supply.

Hornellsville, N. Y.—The water commission voted to direct the council to issue $175,000 bonds for the purchase of the Hornellsville water works. Wm. Richardson, water com.

Rock Island, Ill.—G. G. Craig, jr., comr. of health, recommends that the intake pipe be relaid, the walls of the wells doubled, and that efforts be made to prevent the waste of water.

New London, Conn.—The construction of a new reservoir and about 3 mls. of 16 and 20-in mains is contemplated. Bids will be asked for laying the pipe. W. H. Richards, engr. water dept.

Huntsville, Ala.—The council has refused to renew the contract with the Dallas Manufacturing company to supply this city with water for another ten years, from May 1, 1902, on which date the contract expires.

Berwick, Me.—The Berwick Water company is reported as securing prices on pumps, standpipe, reservoir work, 4 to 10-in. pipe, specials, hydrants, valves, etc., for the proposed water works.

Spokane, Wash.—Plans for a water works system have been completed, and bids will be asked as soon as the question of issuing bonds is voted on, which will be in May. Otto A. Weile, cy. engr.

Akron, O.—The Akron Water Works company contemplates building a reservoir on the side of Sherbondy Hill, to have a capacity of 10,000,000 gals. The company will also add a new 10,000,000-gal. pump to its station.

Holgate, O.—This town voted to issue $15,000 bonds for water works and electric lights, and bids will be opened about June 1 for pumps, standpipe, etc. J. H. Smith, clk.

The question of issuing bonds for the construction of water works will be voted on as follows: De Smet, S. D.; Staunton, Va., Watkins, N. Y.; Hopkinton, Ia.; Harmony, Minn.; Weston, Or.; Bakersfield, Cal.; Hensall, Ont.

The question of issuing water works bonds has been favorably voted on at the following places: Starke, Fla.; Grand Rapids, Wis.; Howard, S. D.; Cloquet, Minn.; Riceville, Ia.; Leon, Ia.; Sheridan, Me.; Lewes, Md.; Laurel, Miss.; Waco, Tex.

The construction of water works is contemplated at the following places: Spanish Fork, Utah; Abbeville, Ia.; Tully, N. Y.; Glidden, Wis.; Janesville, Minn.; Winterset, Ia.; McDonough, Ia.; Herington, Kas.; Wilbur, Wash.; Braidentown, Fla.; Eureka, Utah.

Niagara Falls, N. Y.—The La Salle Water company has been incorporated to build water works here. The company, it is reported, will offer to buy the present water works and to supply water from Lake Erie in this city and other nearby towns.

Cincinnati, O.—Plans and specifications have been submitted for the pumping house for the eastern pumping station. Two estimates were submitted—$119,998 and $126,692—the variance being in whether the building is to be constructed wholly of stone or of brick and stone combined.

Binghamton, N. Y.—The board of water commissioners has decided on a mechanical sand filter plant, American system, for the purification of the city water. The estimated cost is about $101,000. Secretary Anderson has been instructed to procure plans and specifications.

Newark, N. J.—Plans for a water storage reservoir have been submitted by M. R. Sherrerd, engineer of the water department. The reservoir is to be located at Cedar Grove, several miles northwest of this city, and just west of First Mountain. Three earth dams will be required. The estimated cost of the reservoir is $1,500,000.

Frackville, Pa.—(Special)—The water works system, or a part interest in it, is offered for sale to a party who will greatly improve it. If not sold the works will be improved by sinking an immense well 50 ft. in diameter and 35 ft. deep. John Haupt. Owing to an error in the April number of the magazine this item was given as Franklin, Pa.

Columbus, O.—S. M. Gray, M. Am. Soc. C. E., has recommended a new water supply and purification works for this city, at a cost of $3,800,000. The plan involves a high masonry concrete granite faced dam and impounding reservoir on the Scioto river, the development of water power there, a 60-in. steel conduit, a 20,000,000-gal. mechanical filtration and water softening plant, a 12,000,000-gal. clear water basin, a new pumping station, a reinforcement of the distribution system and the erection of three standpipes. Mr. Gray says it is not necessary to do all this work at once, but the portion recommended for immediate construction would cost about $2,200,000. He estimates that mechanical would be cheaper than slow sand filtration by $188,000 for first cost and $19,792 per year for operation, on a basis of 20,000,000 gals. a day; and that for both filtration and softening mechanical filtration is cheaper by $32,357 a year. The additional expense due to softening the water is estimated at $58,855 a year. Mr. Gray believes, however, that the people of Columbus are now paying $221,000 a year on account of hard water.

CONTRACTS TO BE LET.

Goshen, N. Y.—Bids are asked until June 1 for excavating a canal. H. J. Yerg, clk.

Cherryvale, Kas.—Sealed bids are asked until May 20 for constructing a dam and reservoir. S. G. Howard, cy. clk.

Jamestown, N. D.—Bids are asked until May 6 for sinking a 4½ or 6-in. artesian well. Geo. C. Eager, cy. audt.

Joliet, Ill.—Bids are asked until June 17 for improving and increasing the water supply. W. F. McMasters, cy. clk.

Cincinnati, O.—Sealed bids are asked until May 13 for furnishing water pipe, castings, etc. Geo. F. Holmes, clk. B. P. S.

Detroit, Mich.—Sealed bids are asked until May 8 for furnishing 36 and 42-in. iron pipe. Benj. F. Guiney, supt. water comm's.

Levis, Que.—Bids are asked until May 15 for constructing gravity works and a drainage system. F. E. Roy, secy. and treas.

Falmouth, Mass.—Bids are asked until May 2 for furnishing cast iron water pipe.

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valves and hydrants. J. H. Crocker, chmn. comm's.

Cleveland, O.—Sealed bids are asked until May 11 for furnishing hydrants and water gates during 1901. Charles P. Salem, dir. pub. wks.

Dyersburg, Tenn.—Bids are desired until June 1 for a 20-yr. franchise for a water works and electric light plant. W. A. Fowlkes, jr., mayor.

Casper, Wyo.—Bids are asked until May 15, according to press reports, for furnishing 100 tons of 6-in. pipe and 5 tons of lead. E. B. Shaffner, clk.

Cohoes, N. Y.—Bids are asked until May 6 for furnishing 9,000 ft. 4 and 6-in. cast iron water pipe. Jas. Aitken, prest. bd. water com's.

St. Louis, Mo.—Sealed bids are asked until May 7 for steam and feed water piping at Baden pumping station. Robt. E. McMath, prest. B. P. I.

Marquette, Mich.—Sealed bids are asked until May 29 for laying a 42-in. steel riveted intake pipe. F. W. Cappelen, cons. engr., Chicago; J. P. Kern, secy. bd.

Middlebury, Vt.—Sealed bids are asked until May 7 for laying 7 mls. of 6-in. mains to a new source of water supply. Prof. E. C. Bryant, secy. water com.

Yonkers, N. Y.—Bids are asked until May 2 for removing the old boiler and setting and building a new boiler at the low level service station. J. C. Shotts, prest.

Arapaho, O. T.—Bids are asked until May 13 for constructing water works at the Cheyenne and Arapaho Indian Agency, Okla. W. A. Jones, Indian com'r, Washington, D. C.

Dubois, Pa.—Bids are asked until May 21 for a water supply system, consisting of a dam, gate house, one tunnel, 3,450 feet long, and 7 1-3 miles of 20 and 16-inch pipe lines, with other appurtenances. W. A. Engleman, chm. water com.

Cincinnati, O.—Sealed bids are asked until June 18 for furnishing three self-contained, vertical, triple-expansion, crank and fly wheel pumping engines of 25,000,000 gals. capacity and three of 12,000,000 gals. capacity, an electric crane of 30 tons capacity boilers adequate in capacity for the operation of the six engines and their appurtenances. Aug. Hermann, prest. bd. trustees comr's W. W.

CONTRACTS AWARDED.

New Iberia, Ia.—Lewman & Co. of Louisville, Ky., secured the contract for building water works for this place.

Urbana, Ill.—The contract for a new reservoir at the pumping station was awarded to T. E. Taniton of Springfield for $5,000.

Ocean City, Md.—The contract for constructing water works and sewers has been awarded to Rosser & Castoe of Bellaire, O., for $12,999.

Syracuse, Ind.—The contract for constructing water works was awarded to the C. L. Olds Construction company of Ft. Wayne, Ind., for $14,358.

Philadelphia, Pa.—The contract for constructing the upper Roxborough filtration plant and the necessary pipe line has been awarded to D. J. McNichol of this city for $1,300,000.

BRIDGES.

Dover, Del.—Bids are asked until May 7 for building a bridge over Silver Lake. Walter S. Davis, cy. clk.

Fonda, N. Y.—The county supervisors voted April 12 to build a new free bridge across the Mohawk river at Ft. Hunter.

New Castle, Ind.—Sealed bids are asked until May 7 for building seven steel bridges. Co. com's.

Calhoun, Ga.—Bids are asked until June 5 for building an iron and steel bridge across the Coosamattee river.

Terre Haute, Ind.—The Vigo county commissioners have decided to build a new iron bridge across the Wabash river.

Bangor, Me.—Sealed bids are asked until May 13 for erecting an iron bridge. B. H. Coombs, cy. engr.

Buckingham C. H., Va.—Bids are asked until May 15 for a new steel bridge over Hunt's creek. Wm. Peile, rd. engr.

Brookings, S. D.—Bids will be received until May 15 for four steel bridges. J. Alton, co. audt.

Clarksdale, Miss.—Sealed bids are asked until June 3 for a steel bridge across Sunflower river. W. J. Bouldin, clk.

Vincennes, Ind.—Sealed bids are asked until May 13 for erecting 16 steel highway bridges. J. S. Spiker, engr.

Toronto, S. D.—Bids are asked until May 20 for erecting a bridge in Bloom twp. O. H. Quickstad, town clk.

Holyoke, Mass.—(Special)—Jas. L. Tighe, cy. engr., says plans are being drawn for a wooden bridge to be built across the canal at Bridge-st.

Chicago, Ill.—Sealed bids are asked until May 8 for building the substructure and superstructure of a bridge across the Chicago river. Alex. J. Jones, pres. bd. trustees. Sanitary dist.

Youngstown, O.—Bids are asked until May 11 for the stone work for McGuffy-st. bridge. Marcus Waterman, chmn. co. comm.

Warsaw, Ind.—Sealed bids are asked until May 8 for building two steel bridges and two stone arches. W. Y. Chamberlain, cy. engr.

Williamsport, Ind.—Bids are asked until May 7 for four small highway bridges. Norton C. Andrews, engr.

Batesville, Miss.—A new bridge will be erected over the Tallahatchie river at Panola to replace the one that collapsed recently. Bd. co. supvr.

Ft. Collins, Ark.—Sealed bids are asked until May 5 for building a combination bridge across Big Thompson river in Estes Park. H. E. Tedmon, co. clk.

Nashville, Tenn.—A steel drawbridge will be erected over Paint Rock river at New Hope by Madison and Marshall counties.

Carrollton, Mo.—Sealed bids are asked until May 7 for erecting five bridges. Silas Ballard, bridge com'r.

Grafton, N. D.—Bids are asked until May 8 for iron and steel bridges. O. M. Fraser, co. audt.

Vidalia, La.—Sealed bids are asked until May 8 for building three steel bridges. Jas. P. Eagan, prest. Police Jury, Concordia Parish, La.

Dublin, Ga.—A. R. Anau, Wm. Kea and J. M. Blackshear have been appointed a committee to receive plans and specifica-

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tions for the proposed extension of the Oconee river bridge. Bids will be asked soon.

Dunkirk, N. Y.—Sealed bids are asked until May 7 for building iron bridges over Douglass creek at E. Pine and N. Beagle sts., cy. engr.

Akron, O.—Bids will probably be asked in May for a Melan arch bridge across the Ohio canal, at Falor-st. J. W. Payne, cy. engr.

Indianapolis, Ind.—Sealed bids are asked until May 14 for constructing bridges over Goose creek, near West Newton; McGuires' creek, Decatur twp.; Dollarhide creek, Decatur twp. Jas. E. Green, chmn. co. com.

PARKS.

Helena, Mont.—Plans for the improvement of the public parks are being considered by the council.

Chicago, Ill.—Unimproved lots and plats of ground which are the property of the city are to be temporarily utilized as small parks and public play grounds.

Abilene, Kas.—The question of establishing a public park is being considered. A. B. Rose, E. H. Forney and F. L. Ball have been appointed a committee to select a site.

STREET LIGHTING.

Johnstown, Pa.—The council will appropriate $20,000 for lighting the city for one year.

Hubbard, O.—The municipal electric light plant was destroyed by fire recently.

Dayton, Wash.—The advisability of purchasing the city electric light plant is being considered.

Montpelier, O.—The council has decided to issue $6,000 bonds for extending the electric light and water works plant.

Blenheim, Ont.—Bids are asked until May 2 for erecting a light plant. John Nicholl, fire, water and lgt. com.

Mansfield, O.—Sealed bids are asked until May 11 for lighting this city for two years from July 1, 1901. F. M. Remy, cy. clk.

Brazil, Ind.—This city contemplates building a municipal electric light plant.

Rock Hill, S. C.—The question of issuing $55,000 bonds for purchasing the plants of the Rock Hill Water, Light and Power company will be voted on.

Washington, D. C.—Sealed bids are asked until May 6 for a gas machine house and acetylene gas machine fixtures. W. A. Jones, Indian com., Washington, D. C.

Fond du Lac, Wis.—The business men have organized a stock company for the purpose of establishing a new electric lighting plant.

Los Gatos, Cal.—An ordinance has been passed providing for an expenditure of $10,000 for an arc light system.

Hedrick, Ia.—The city council passed an ordinance providing for the construction of a gas plant at a cost of $5,000.

Oxford, Mass.—A committee has been appointed to investigate the question of lighting the streets with electricity. E. S. Pease, twn. clk.

Melrose, Mass.—Sealed bids are asked until May 15 for lighting the streets of this city. W. Dobney Hunter, engr. and supt. pub. wks.

Pottsville, Pa.—Bids are asked until June 4 for lighting the borough for 5 or 10 years from Feb. 15, 1902. G. A. Berner, town clk.

Reading, Mich.—Sealed bids are asked until May 14 for erecting a municipal lighting plant. Glen E. Stowe, vil. clk.

El Paso, Tex.—Sealed bids are asked until June 1 for lighting this city for 5 years, from June 1, 1902. S. G. Peticolas, cy. electrician.

Sullivan, Ind.—Bids are asked until May 2 for lighting the city for 5 or 10 years, from Jan. 1, 1902. David Crawley, clk.

Bangor, Me.—The committee of street lighting has been authorized to secure bids for a municipal lighting plant, to cost about $47,000.

The question of issuing bonds for building electric light plants will be voted on as follows: Mansfield, O., May 6; Covington, Ga., May 1; Kissimmee, Fla., Geneva, O., May 11.

Glenwood Springs, Col.—An ordinance has been adopted providing for the issue of $30,000 bonds for the construction of an electric light plant.

Electric light plants are contemplated at the following places: Burlingame, Kas.; Neponset, Ill.; Harrisburg, Va.; Medford, O. T.; Roanoke, Ala.; Manchester, Vt.; Winchester, Tenn.; New Ulm, Minn.

The question of issuing bonds for electric light plants has been favorably voted on at the following places: Butler, Mo.; Tullahoma, Tenn.; Fairfield, Ia.; Dunkirk, O.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Montclair, N. J.—This town voted $5,500 for garbage collection.

Cann for $2,200.

Jamestown, N. Y.—Mayor Johnson recommends the erection of a garbage crematory in his annual message.

Washington, Pa.—An ordinance has been passed dividing this borough into four districts for street cleaning.

Racine, Wis.—The contract for sprinkling State-st. was awarded April 13 to A. H. Allen at 12½ cts. a lin. ft.

Dayton, O.—Specifications for a garbage crematory are being prepared by F. M. Turner, cy. engr., and bids will be asked soon.

Atlanta, Ga.—Sealed bids are asked until May 10 for the reception and disposal of the garbage, night soil, etc., for one year. Dr. B. W. Bizzell, 114½ Peachtree-st.

Madison, Wis.—The council will let three contracts for collecting garbage, waste, etc. the citizens to provide their own metal receptacles. Alderman Sparling, interested.

Columbus, O.—An ordinance has been introduced authorizing the director of public improvements to purchase or rent the necessary tools and machinery for cleaning, sweeping and sprinkling the streets. The sum of $5,000 is provided for this purpose.

TOO LATE FOR CLASSIFICATION

Ozark, Ark.—Bids are asked until May 8 for two steel bridges. W. M. Quaile, co. comr.

Cohoes, N. Y.—Bids are asked until May

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7 for the removal of garbage. Wm. J. Ellcott, cy. clk.

Wabash, Ind.—Bids are asked until May 27 for improving Wilson-st. Robt. P. Woods, cy. engr.

Bangor, Me.—Bids are asked until May 13 for a span iron bridge. C. C. Porter, st. engr.

Lansdowne, Pa.—Bids are asked until May 3 for cement walks during 1901. H. L. Warren, engr.

Binghamton, N. J.—Bids are asked until May 14 for electric lighting, according to press reports.

Carver, Minn.—Bids are asked until May 6 for two stone arch bridges. Oswald C. Brunius, vil. rec.

Watertown, N. Y.—The board of water commissioners have decided in favor of installing a filtration system.

Wabash, Ind.—Plans are being adopted for a sewer for the Charley Creek district. Robt. P. Woods, cy. engr.

Minnesota, Minn.—Sealed bids are asked until May 15 for a water works system. M. E. Drake, vil. rec.

Dunkirk, N. Y.—Sealed bids are asked until May 7 for a sewer in Eagle-st. Jas. P. Morrison, cy. engr.

Blakely, Ga.—A committee has been appointed to make ac ontract for constructing water works and electric light plant.

New Orleans, La.—Bids are asked until May 3 for paving a portion of Canal-st. with asphalt. V. Tujague, compt.

Redfield, S. D.—Sealed bids are asked until June 3 for sewers on Emerson-st. and Franklin-ave. J. S. Huston, cy. audt..

Dunkirk, N. Y.—Bids are asked until May 7 for two iron bridges across Douglass creek. James P. Morrisey, cy. engr.

South Bend, Ind.—Sealed bids are asked until May 14 for 7,000 sq. yds. of brick pavement on W. Navarre-st. A. J. Hammond, cy. engr.

Mercer, Pa.—Bids are asked until May 13 for stone work on several bridges, and for three stone arches. L. H. Miller, clk. co. com's.

Morristown, N. J.—Sealed bids are asked until May 14 for acadamizing numerous roads. Henry M. Darlymple, dir. bd. chosen freeholders.

Clarksdale, Miss.—Sealed bids are asked until May 7th for an electric light plant. W. D. Barry, chmn. w w & elect. lgt. com.

Alexandria, Ind.—Sealed bids are asked until May 20th for paving certain alleys with vitrified brick. J .S. Humphrey, cy. engr.

Missoula, Mont.—Sealed bids are asked until May 6 for 6,200 ft. of 4-in. water pipe with valves and connections. W. F. Hughes, cy. clk.

Scranton, Pa.—Bids are asked until May 2 for a sewerage system consisting of 6,750 ft. of 8 to 18-in. pipe. Joseph P. Phillips, cy. engr.

Cleveland, O.—Sealed bids are asked until May 11 for a steel bridge across Rocky river, in Strongsville twp. Julius C. Dorn, clk. bd. co. com's.

Ridgefield Park, N. J.—Sealed bids are asked until May 6 for building sewers and drains in numerous streets. Geo. J. Smith, clk. bd. trustees.

Cincinnati, O.—Bids are asked until May 23 for keeping in repair for one year the asphalt pavement on Race-st. Geo. J. Holmes, clk. B. P. S.

Racine, Wis.—The residents on Milwaukee-ave. desire brick paving instead if macadam.

Boston, Mass.—Bids are asked until May 13 for constructing Mattapan bridge and approaches, Blue Hills parkways, Boston and Milton. Wm. T. Pierce, engr. Met. Park Com'n.

Elmira, N. Y.—Bids are asked until May 4 for 10,000 sq. yds. of asphalt paving and 7,000 lin. ft. of sandstone curbing on Market and Lake-sts. C. W. Wyckoff, cy. clk.

Lafayette, Ind.—Sealed bids are asked until May 15 for furnishing one pumping engine of 6,000,000 gals. and two pumping engines for 1,000,000 gals. Geo. E. Flehmeyer, chmn. trustees.

Glens Falls, N. Y.—Sealed bids are asked until May 6 for 5,000 ft. of 6 and 2,000 ft. of 4-in. cast iron water pipe. Geo. P. Slade, vil. engr.

Atlanta, Ga.—Sealed bids are asked until May 16 for furnishing and delivering about 113,300 ft of water pipe and valves, specials, hydrants, lead and yarn. Park Woodward, supt. w. w.

Chester, Pa.—Bids are asked until May 6 for cleaning the streets, and for the removal and disposal of garbage, dead animals, etc., during 1901. W. I. Cullis, chmn. st. com.

Westchester, Pa.—Sealed bids are asked until May 4 for 3,774 ft. of sewer pipe of various sizes, and for digging trench, laying pipe and filling trench. Fred Heed, chmn. st. com.

Chicago, Ill.—Sealed proposals are asked until May 8 for paving Michigan-ave., from Jackson to Congress-st. and from Sixteneth to Eighteenth-st. with asphalt. E. G. Shumway, secy. South Park com's.

Gleenville, O.—Sealed bids are asked until May 21 for a settling basin and appurtenances in the sewage disposal works, and for sewers and appurtenances in Elbert-st. and Robinson-ave. Ira C. Farley, vil. clk.

West Newton, Mass.—Sealed bids are asked until May 13 for 69,000 ft. of sewer pipe with bends, branch connections and stoppers. Also for building 2 sections of sewer in Rock Tunnels at Hemlock George. Street com'r.

Pottsville, Pa.—Sealed bids are asked until May 7 for furnishing terra cotta sewer pipe and fittings, machine broken trap rock, furnace slag or stone or hard broken stone, and furnishing and laying curbing guttering, stone street crossings and brick sidewalks. G. A. Berner, town clk.

Danville, Ky.—Sealed bids are asked until May 2 for constructing a sewerage system, consisting of 8,700 ft. of 10-in., and 23,300 ft. of 8-in. tile sewers, 130 manholes, 16 flush tanks and 3 septic tanks. J. B. Fisher, chmn. sewer com.; Alvord & Shields, engrs.

Philadelphia, Pa.—Legal proceedings were begun April 18 to restrain the execution of asphalt contracts between this city and the Vulcanite Paving company, the Pennsylvania Asphalt Paving company, the Richardson & Ross Asphalt Paving company and the Alcatraz Paving company. The complainants are Warner-Quinlan.

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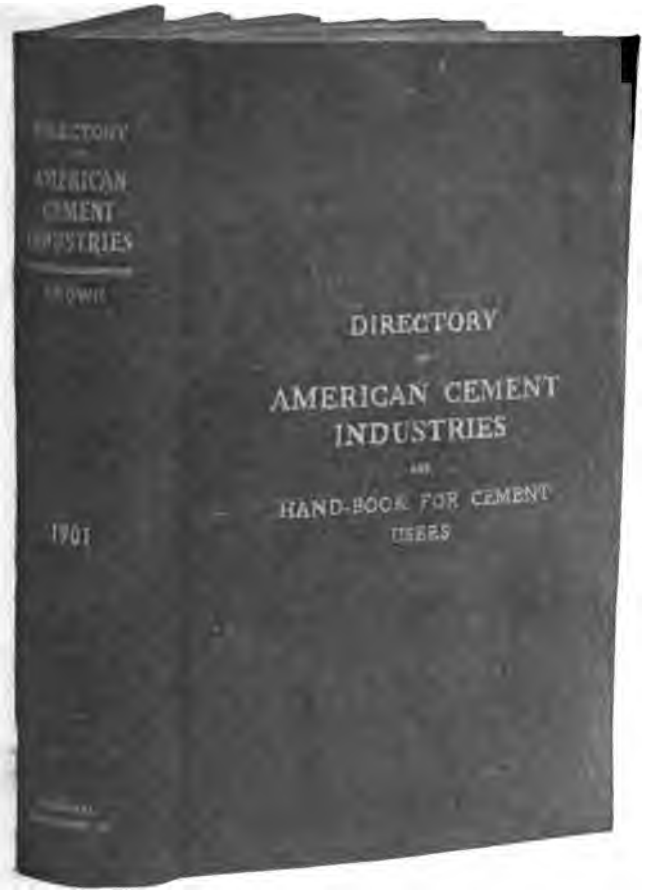

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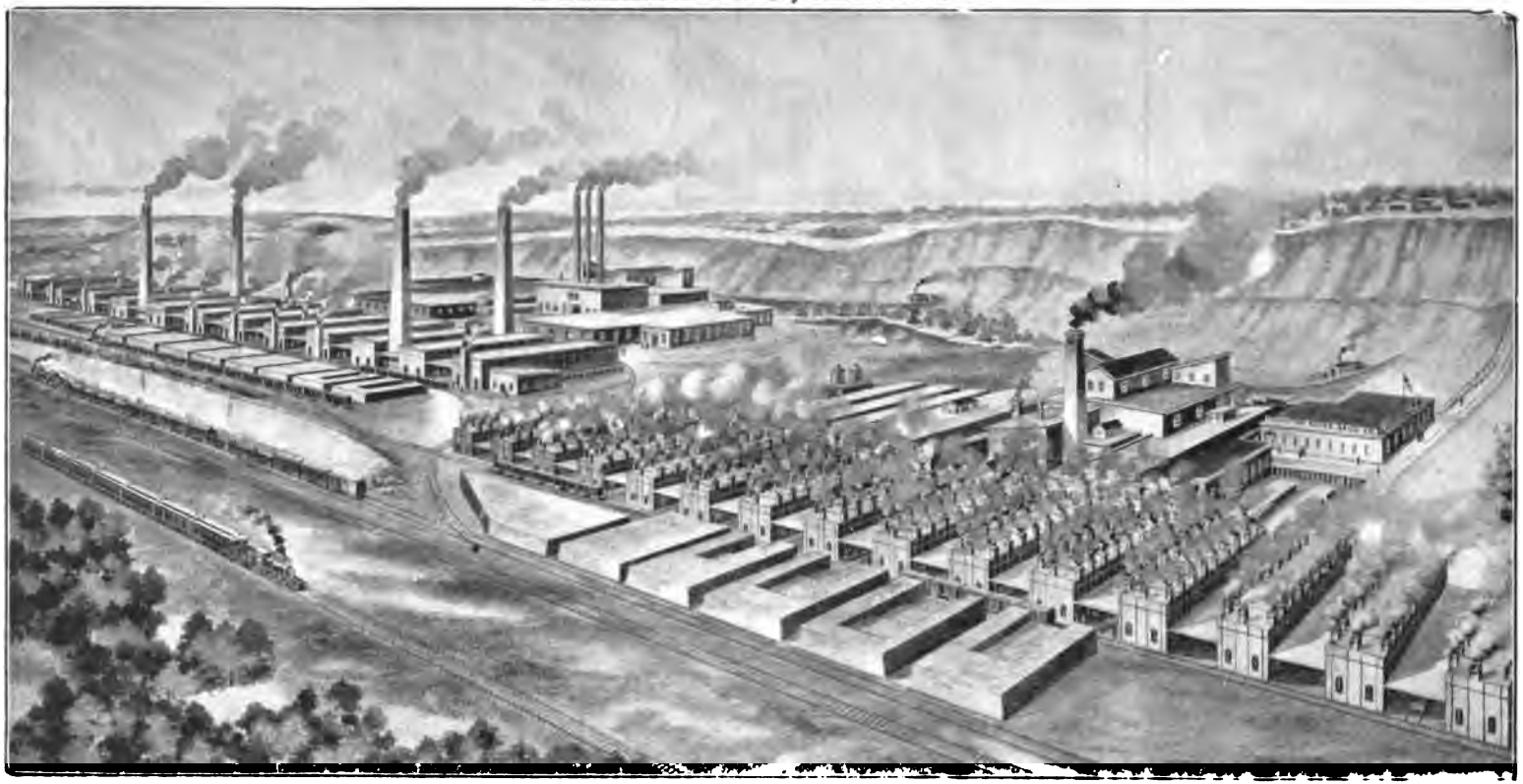

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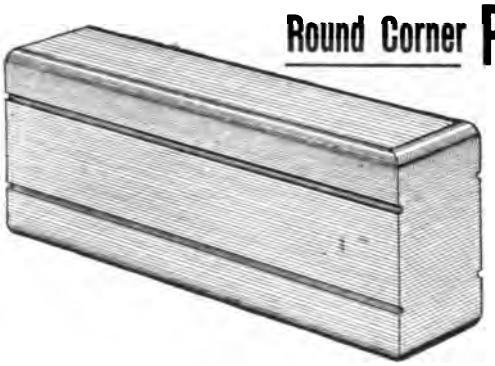

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VOLUME XX. JUNE, NINETEEN HUNDRED ONE. NUMBER 6.

TAR MACADAM AS USED IN HAMILTON, ONTARIO.

By Fred J. Warren, Boston, Mass.

In April, 1901, while on a visit to Ontario, I took occasion to stop at Hamilton, to inspect their tar macadam, reports of which I had seen in the public prints from time to time. The information was of great use to me, and is recorded in an endeavor on my part to rectify certain erroneous impressions which might be gathered from articles written on the subject heretofore.

It is essential, in considering the value of a pavement, to note the conditions of traffic to which it is exposed. In all previous reports of the Hamilton work which have come to my observation the traffic is termed as "light" or "heavy." These are merely comparative terms, and carry no conception of the amount of traffic, except to those intimately acquainted with Hamilton conditions. As a matter of fact, what would be considered as "heavy" traffic in Hamilton, would be classed as "very light" in hundreds of cities in the United States. The heaviest traffic in Hamilton is near the water front, where tar macadam is not used, and most of its business is in lake freight which does not pass over its streets. The tar macadam is used only on residential and retail business streets, where the chief traffic is such as comes from local retail delivery wagons. The tar macadam is exposed to so little traffic that Mr. Wingate, the city engineer, called attention in his report to the fact that most of the material used in constructing the Collegiate Institute was hauled over West avenue, which had then been down a few years. The institute is not a larger building than are many high schools in cities of from 40,000 to 60,000 inhabitants, so we can readily see that the hauling of the materials over West avenue would not subject the pavement to severe usage. In the following account I shall endeavor to state the traffic conditions in a way which will be comprehensive.

I arrived in Hamilton Sunday night, April 21, and examined the pavements on Monday, April 22. It was just after a heavy rainstorm which left the pavements much washed, some of them so dirty from adjoining streets that they could hardly be examined, and others so clean that the true condition, which varied from good to worthless, could be readily seen. The asphalt pavements were of poor quality, such as could be expected when laid by a local company without proper experience, and the regular macadam roads were of a low grade. (See Plate I.) It is not surprising that with poor asphalt and poor regular macadam, the tar macadam is, comparatively speaking, a success, even though it is vastly inferior to good regular macadam such as is laid in many New England cities.

My examination of the Hamilton work was confined to half a day, and seeing that some useful views could be taken, I engaged a photographer and carriage and examined the nearest section of each tar macadam street, as my time would not allow of inspecting their entire lengths. There were twenty-four photographs taken, the first at 10:40 A. M., the last at 1:30 P. M. Following I will give extracts from my note-book, based on the photographs, on information obtained from Mr. Wingate's report, and on personal observation and consultation with the photographer, hack driver, and Mr. Ashley, foreman of the gas company, who laid the first street—Mulberry.

Mulberry street from Park street to gas works was laid in 1880; from entrance to gas works to Bay street was laid in 1883 by the gas company, under direction of Wm. Ashley, the present foreman, with a crown

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I. ORDINARY MACADAM STREET IN HAMILTON, ONT.

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II. HAMILTON, ONT. MULBERRY STREET, TAR MACADAM. LAID IN 1880. NO REPAIRS.

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4 inches to 6 inches, in width 40 feet. There are no car tracks. Traffic Record—8:20 to 8:52—32 minutes—my carriage, 4 empty, single-horse, express wagons, and one single load of coke weighing about 700 pounds. Mr. Ashley said that the gas company teams hauled about 9,000 tons over the street per year, which was about half the total traffic. Said he was foreman for Crystal Palace Gas Company, London, and laid similar work there, which is in good condition after thirty-five years of wear. Said present work in Hamilton is not good because tar is poor and enough labor is not put in. Mulberry street has had no repairs.

At the 1883 end, some parts of center show no wear. Even on line of greatest travel and on sides, the wear has not yet got down to the stone, the wearing surface still existing. Mr. Ashley says surface was two inches or more thick and stone were well coated. When laid, this street was objectionably soft and mushy.

Photograph, taken at 12:45 P. M., of 1880 end of Mulberry street. (See Plate II.) All original surface is worn away, presenting stone to wear. Stone used was harder than that used in more recent work, but is poor, when compared with hard trap rock. Tar concrete mortar is now hard, but cements the stone firmly together, the stone showing no signs of crushing or loosening.

This pavement will, in my opinion, outlive the average laid in 1900. The exact conditions under which it was laid are not recorded, but the following conclusions can be drawn from these two early specimens:

1st. The bitumen used has stood a life of twenty-one years.

2d. The large mineral grains do not chip out under traffic when bound together with finer matter and coal tar bitumen.

3d. When properly laid, good bitumen will bind stone together until stone will wear out under heavy traffic.

Stuart street, on the north side, near the Grand Trunk depot, was laid in 1900. It is badly dried out, so that the tar has lost its cementing properties in many places, probably due to the following reasons:

1st. Too little tar used.

2d. Sand used was of too even size.

3d. Tar poor as to quality and softness.

Some parts of the street are much better than others, and if roughly examined, show fair condition, but the tar has added little value as a whole. Traffic, 8:54 to 9:10—sixteen minutes, two empty double teams, one empty single team; no loaded teams.

On side-hill, water has washed out the gutter to depth of six inches in one place.

Stuart street, south side, was laid in 1899, and is in better condition than the north side, but is not good. Traffic in eight minutes, one loaded team, about 3,000 pounds (the heaviest load seen on any of the tar macadam work); one express wagon, with eight trunks. This street has double car tracks. (See Plate III, for view of its condition.)

York street, between Bay and Caroline, was laid in 1900, is 45 feet wide, with two car tracks. Traffic, 9:19 A. M. to 9:31—twelve minutes—Five empty teams, four one-horse loads, two baby carriages, one buggy. Probably the hardest used street paved with tar macadam. There are sixteen places in one block that have worn two inches or more below a line produced by straight edge—one large, about 9 feet by 9 feet, more than 2 inches deep. More than twenty places are worn about one inch deep. In most places where water stood at 9:30 A. M. it had entirely disappeared at 12:30 with sun not out. Roadway is porous permitting free access of air and water, which causes rapid disintegration, movement under traffic, and wear.

King street, West, between Bay and Caroline, was laid in 1899, 45 feet wide, with two car tracks. The north side is worn in chuck holes two feet from track on line of travel. Water stands one-half or more inches deep in 43 places. Traffic, 9:38 to 9:46—eight minutes—Three single empty delivery wagons, three loaded wagons; empty double wagons, none; loaded double wagons, none. All wagons delivery, grocery, milk, bakers', etc. South side of street is in much better condition. (See Plate IV, showing its condition.)

St. James street, South, was laid in 1900. It shows little wear except in a few spots. It is 36 feet wide, with two car tracks. Traffic, 10:17 to 10:23—six minutes—Two single empty delivery wagons, one single loaded wagon (bakery). No other teams.

West avenue, between Hunter and Stinson streets, was laid in 1893. It looks better than recent work. About 5 to 15 per cent. of its area shows repairs. Traffic, 11:25 to 11:30—five minutes—Two delivery wagons on a length of three blocks.

Victoria street, between Hunter and Stinson, was laid in 1900. It has no tracks, very little traffic, and is in good condition apparently. Traffic, 11:35 to 11:40—five minutes—No teams or vehicles passed on three blocks.

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III. HAMILTON, ONT. STUART STREET, TAR MACADAM. LAID IN 1900.

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IV. HAMILTON, ONT. KING STREET, TAR MACADAM. LAID IN 1900.

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East avenue, between Hunter and Stinson, was laid in 1900. It shows some wear, but is generally in fair condition. Traffic, 11:47 to 11:50—three minutes—One bakery wagon.

The only conclusion as to the worth of tar for road building, as deduced from Hamilton's experience, must be drawn from the work done in the first stages about twenty years ago. The recent work is an abomination from a road-builder's standpoint. There are thousands of miles of macadam in Massachusetts and New Jersey vastly superior to the average tar macadam of Hamilton as laid last year, and under harder usage. The errors can all be attributed to

1st. The improper selection of the mineral matter.

2d. The improper separation of the sizes.

3d. The use of some poor stone.

4th. The use of improperly selected and prepared bitumen.

In fact, the authorities have gone along without any previous knowledge of the right methods of preparing bituminous concretes and have spent a lot of money in experiments. They have ignored all previous experience in the use of bituminous substances and fallen into all of the errors which caused the early abandonment of tar street pavements in the sixties and early seventies, and have added to the list of errors some hitherto undeveloped ones.

There is nothing more certain in the use of any kind of bitumen than that no mixture will give life unless practically impervious. If there is no traffic on it some of the work might last a few years, but under moderate traffic, such as cities generally have, such pavements would last but a very short time. Under very heavy traffic the wheels of vehicles might in some cases act as a mixing machine, and might tend toward giving a dense mixture. In practice, in Hamilton, they count on teams to do their mixing and compressing, and if they fail to do it, the pavement is left porous, and as a rule the tar used is absolutely ruined by exposure in minutely divided sections before any considerable mixing takes place. In addition to this they use a top dressing, in some cases at least, which in itself develops about fifteen per cent. of net voids after the bitumen has been added.

After my investigation I met the city engineer, board of public works, mayor and others, and was treated so cordially by them that I would be tempted not to criticise the Hamilton methods did I not most sincerely believe that the cities of this country need to be cautioned against similar errors. It is hardly necessary for me to make excuses for the officials for their part in the errors, for every city in this country, that had early asphalt pavements or other forms of bituminous concretes, is familiar with the errors that have been made by all contractors in learning the industry, and Hamilton's condition is but the result of trying to do work without experience. It is far cheaper and better in the long run to hire the experience that some other community has paid for.

The country, as a whole, in thirty years, has paid about $10,000,000 in way of repairs for the privilege of learning how to use the bitumens in concrete roadway and sidewalk structural work, and while the best knowledge is within the control of comparatively few people, there are enough men and concerns available that can and will furnish more or less accurate advice at such reasonable rates that cities or contractors can not at this time afford to develop their own experience without any previous training on the subject unless they hire the experience to start with.

GARBAGE DISPOSAL IN LAFAYETTE, INDIANA.

By Severance Burrage, S. B., Professor of Sanitary Science, Purdue University.

For several years Lafayette has been laboring with the problem of the disposal of its garbage, and at last is to be congratulated upon having found a most efficient and satisfactory method. The old-fashioned way of throwing the garbage into the back-yard for hens and other animals to eat is seldom if ever seen now within the regular city limits. In the suburbs, however, the animal-feeding method is still in vogue. For many years Lafayette has had an excellent water supply, so that there has been practically no typhoid fever to contend with. The death-rate from other causes, however, has been high compared to that in other cities of about the same size. This has been due to several reasons, one of the most important of which was the partial method of sewage disposal, by which a portion of the household sewage was col-

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lected in the city sewers, while other portions remained on the surface of the yards, sidewalks, and street gutters. This material consisted largely of kitchen wastes, sink drainage, etc., and was very apparent even in the most thickly settled portions of the city. With the introduction of a well-organized system of garbage collection, this last evil has been in part remedied, so that now the only kitchen waste which is evident about the streets is the wash water.

A few years ago a garbage crematory plant was put in on trial, and was believed by those in authority not to fulfill all the conditions of the contract, and it was subsequently removed. After much study and discussion, the city built a crematory in September, 1899, which has been in operation since.

V. LAFAYETTE, IND. GARBAGE WAGON DUMPING.

The wagons which are used in the collection of garbage are made especially for the purpose. They are the most satisfactory, as far as mechanical contrivance is concerned, as well as the most inoffensive garbage wagons which the writer has ever seen. Figure V shows one of these wagons in the process of dumping garbage into the crematory. The only possible objection to them is the noise which is necessarily made by the empty metal wagons in going over rough pavements. The drivers of these wagons are compelled to keep the covers closed while passing through the streets, but while collecting garbage in the alleys they are permitted to keep them open; they can do this, of course, with very slight offense. There are four of these special garbage wagons, and these are kept busy every day in the week, except Sunday, hauling the garbage to the crematory. They are supposed to visit every residence twice each week. The drivers of these wagons get $60 a month.

Although the process of garbage disposal has been one which has attracted the attention of many expert sanitarians, with the object in view of making garbage disposal a paying institution—that is, to extract or render materials and substances from the city wastes which might be of some value, either as a fertilizer, chemical product or for some other commercial value—nevertheless, these various reduction plants, largely experimental, have not proved a very great success from a financial standpoint, because the necessary processes of extraction, and so on, are so expensive in themselves. Thus it is hardly possible, at present, for the city to make money through its garbage disposal department. Under the present status of the various systems of garbage disposal, there seems to be no question that the cremation process, in its simplest form, is the most desirable. The main object, then, of a garbage crematory is to effect garbage cremation, practically in the heart of the city, in such a manner that offense is given to no one.

The crematory has been in operation for

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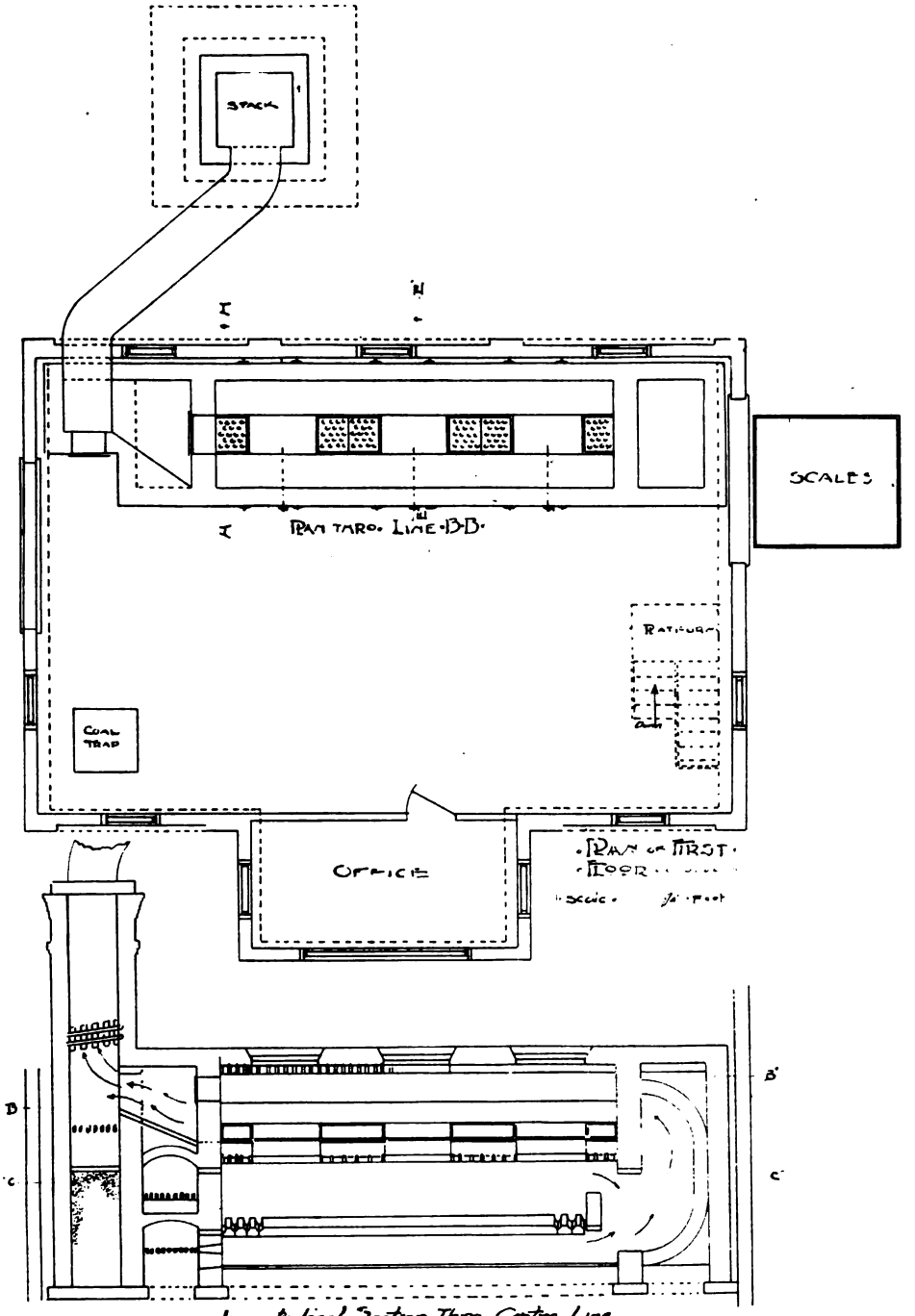

Longitudinal Section Through Centre Line.

VI. LAFAYETTE, IND. PLAN AND SECTION OF GARBAGE CREMATORY.

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nearly a year and a half, and there have been practically no complaints from the citizens in regard to offensive odors from the stack, or from any other source. In fact, the citizens are so much tied to the present system of collection and cremation, that if for any reason the collection ceases for a day or so they immediately raise objection. The crematory at Lafayette is very simple in its arrangement, and apparently is doing its work. The capacity of the furnace is twenty-four tons of liquid garbage per day, but the amount of garbage which is disposed of by the city at the present time never exceeds fourteen tons, and probably will average about twelve tons. The furnace is provided with four large openings into the upper room, through which the garbage is received. The wagons are backed up to these openings, and the garbage, both liquid and solid, emptied directly onto the fires. The accompanying plan Plate VI will illustrate the arrangement of the furnace in general. No special provision is made for the liquid parts of the garbage. The longitudinal section shows how the heat from two fires passes up and over the garbage, for the purpose of destroying the disagreeable odors which arise during the consumption of this large quantity of garbage. Special provision is made by this furnace for the destruction of night soil. As the odors resulting from the consumption of night soil are extremely offensive, an auxiliary fire of coke is built at the base of the stack, the object of which is to heat the stack to such a degree that the odors will be absolutely destroyed. However, at the present time Lafayette is not destroying much night soil in this way.

The accompanying photograph of the crematory building, VII, shows its location in relation to the water-works plant. Situated close together, as they are, the crematory is enabled to utilize the water-works stack, and thus the city saves the expense of constructing a special stack. There was a slight objection on the part of some citizens to having the crematory plant so closely connected with the water supply, but the water being derived from driven wells in the bed of the river, several hundred yards away, there seems to be no possibility that the crematory would in any way affect the water. Recent analyses of the water, at any rate, show no change from three or four years ago. The crematory was completed about September 1, 1899, and cost the city the initial sum of $8,400. The salaries, coal, wagons, etc., will amount to about $375 a month. The fuel cost per ton of garbage consumed is between twelve and thirteen cents. The principal objection to the plant as it exists at the present time is the lack of strength in the walls which support the furnace, and the experience of this Lafayette furnace may serve as an object lesson to others introducing similar plants. The contractors are apt to overlook the effect of the extreme heat, the weight of the arches, as well as the weight of the garbage, in the construction.

The garbage ordinance, under which the garbage collection is carried out, is most excellent, and may well serve as a copy for other cities about to introduce systems of garbage disposal. This ordinance is appended in full.

"AN ORDINANCE TO REGULATE THE COLLECTION AND DISPOSAL OF NIGHT SOIL, GARBAGE, ETC., AND CONCERNING THE MANAGEMENT AND OPERATION OF THE GARBAGE FURNACE IN THE CITY OF LAFAYETTE.

"SECTION 1. Be it ordained by the Mayor and Common Council of the city of Lafayette, Indiana, That for the purpose of this ordinance, the word 'garbage' shall be held to include kitchen and table refuse, swill, rubbish, and every accumulation of both animal and vegetable matter that attends the preparation, decay and dealing in or storage of meats, fish, fowls, birds or vegetables, but not dishwater or waste water. The word 'dirt' shall be held to be natural soil, earth and stone. 'Night soil' shall mean the contents of privy vaults, cesspools, dry wells and sinks; 'rubbish' shall be held to mean paper, rags, pasteboard boxes, berry boxes, sweepings, chips, tinware, and rubber and leather of all kinds.

"SEC. 2. All garbage, night soil and other accumulations of noxious, vegetable or animal matter (except stable manure), and all dead animals hereafter found or collected in said city, shall be burned in the garbage furnace of said city: *Provided, however*, that stable manure may be burned in said furnace, and provided, also, that swill may be disposed of by feeding to hogs outside of said city limits, but in such case the person or persons hauling or carting the swill away must do so by hauling it in covered vessels free from leakage, so that it can not be spilled out on the streets or alleys of the city in the hauling: *Provided, further*, that all crockery, glass bottles, brickbats, plaster, and other such noncombustible ma-

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terial are excluded from the garbage receptacles used for the collection of garbage and shall not be deposited in the garbage furnace.

"No accumulations mentioned in this section shall be burned upon any street, alley, commons, or public place, or upon any premises, in open air, within the limits of said city.

"SEC. 3. It shall be unlawful for any person or persons to throw or deposit, or to cause to be thrown or deposited, or to permit the throwing or depositing, of any garbage, dirt or night soil (as these terms are defined in this ordinance), manure, glass, glass bottles, queensware, crockery, brickbats and plaster (the last two articles except when done under building permits), or any nuisance or filthy matter upon any street, alley, gutter or public grounds of said city, or into any streams running through or adjacent to said city.

"SEC. 4. It shall be the duty of every tenant, lessee or occupant of any private dwelling-house to provide, and at all times to keep within such building, or on the lot on which such building is situated, suitable and sufficient vessels, with bail or handles, with tight covers thereto, for receiving and holding, without leakage and escape of odors, and without being filled to within four inches of the top, all the garbage that may accumulate in the premises between the times of collection as may be established by the common council; and all such vessels shall be placed at all times in such places as to be readily accessible for removing or emptying (upon the line of the alley where practicable), and where they shall not be a public nuisance in any respect, or be placed within the limits of a street or alley.

"SEC. 5. It shall be the duty of each such tenant, occupant or lessee to place in such vessel or vessels all garbage accumulating in his or her said house, or on his or her said premises, between the times of removal, as may be established by the common council. Nothing but garbage, as in this ordinance defined, shall be placed in such receptacles.

"SEC. 6. All garbage collected at any private dwelling-house will be removed by said city at its own expense, and at such regular intervals as may be from time to time established, taken to and consumed in the garbage furnace.

"SEC. 7. All accumulations of garbage originating at any boarding-house, hotel, grocery, butcher shop, meat, vegetable or fish stand, or other place not a private residence, shall be burned in the garbage furnace. All such accumulations shall be kept upon the premises and conveyed to the garbage furnace in such manner as to avoid offense to the citizens of said city, and deposited in such furnace, under the direction of the keeper of the same, by the person responsible for said accumulation, at his own expense, at least as many times per week as said city collects garbage from private residences, and between such hours as may be prescribed therefor. All accumulations of manure, straw, sawdust, shavings, boxes and other combustible matter, not before mentioned in this section, originating at any of the places set forth in this section, shall be properly cared for and disposed of by the person responsible therefor, and when

VII. LAFAYETTE, IND., GARBAGE CREMATORY AND WATER-WORKS.

conveyed to the garbage furnace by such person, shall be consumed in like manner as garbage and other combustible matter, and all such accumulations, when being conveyed along any street or alley by such person, shall be so conveyed or secured as not to be spilled or thrown out upon such street or alley, or adjacent premises; nor shall the same be kept or stored upon any street, alley or public place, except as in this ordinance provided.

"SEC. 8. All persons owning or controlling slaughter-houses within the city, or within two miles thereof (not located in any other town or city), shall remove all offal accumulating therein to the garbage furnace at their own expense, to be burned therein, such removals to be made at least as many times per week as the city collects garbage, and between such hours as may be provided

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therefor, and in such manner as to avoid offense to the citizens of said city.

"SEC. 9. No straw or manure from any premises shall be permitted by any person having charge or controlling such premises, to accumulate or be deposited on any street, alley, commons or public grounds within said city, except as herein provided. No manure box shall be placed in any street. All boxes placed in alleys for holding manure shall not extend more than two feet upon said alley, and shall have lids, and said boxes shall be kept closed, except when the manure is being placed therein or taken therefrom, and in no instance must the manure be placed in or upon said box so as to prevent the closing of the lid. All manure not used for the fertilizing of gardens or lawns within the city, must be disposed of by the owner or occupant of the premises where the same is accumulated, either by conveying or causing the same to be conveyed beyond the city limits, or taken to the garbage furnace, at the option of such owner or occupant. When taken to the garbage furnace by such owner or occupant it shall be destroyed in the garbage furnace by said city. Such manure, in being hauled over the streets or alleys of said city, must be hauled in such manner so as to prevent any part of it from being dropped or spilled upon such streets or alleys.

"SEC. 10. No night soil shall be removed by any person without first procuring a written permit therefor from the health officer of said city. Such permit shall be exhibited on demand of any policeman, or of any person for whom said person having said permit shall be doing, or shall offer to do, such work. Such person holding such permit intending to convey night soil to the garbage furnace for destruction, shall notify the person in charge at such furnace at least twenty-four hours before the delivery of the same of such intention.

"SEC. 11. Each person holding such permit shall furnish suitable wagons, barrels and carts for the removal of night soil, and shall have air-tight and water-tight vessels which shall be tightly sealed when hauled through said city. Such vessels and all other apparatus used shall be kept clean and disinfected, to the satisfaction of the health officer.

"SEC. 12. All night soil shall be thor oughly deodorized before being stirred up or removed. Every vault from which night soil is removed shall be thoroughly cleansed and deodorized by the collector.

"SEC. 13. The health officer shall issue such permits on application. Such permit shall contain the name of the person from whose premises the night soil is to be removed and the name of the street and the house number, and shall be delivered to the keeper of the garbage furnace by the collector upon taking the night soil there.

"SEC. 14. The garbage furnace shall be placed in the charge of a keeper, to be chosen by the common council, whose term of office shall be one year. Such keeper may be removed at any time as said council may determine.

"SEC. 15. The Committee on Nuisance shall have the power to establish rules of regulation governing the collection and disposal of the garbage of said city, and not inconsistent with the provisions of this ordinance.

"SEC. 16. Any person doing any of the acts forbidden by this ordinance, or failing to perform any of the duties imposed herein, or violating any of the provisions of this ordinance, shall, upon conviction, be fined in any sum not less than five dollars, nor more than $100.

"SEC. 17. All ordinances and parts of ordinances in conflict with this ordinance are hereby repealed.

"SEC. 18. This ordinance shall be in force and effect from and after its passage and publication once each week, for two consecutive weeks in a daily newspaper printed and published in said city of Lafayette."

RETURN CABLES VS. RAIL BONDING.

By Alton D. Adams, M. A. I. E. E., Boston, Mass.

In every city where an extensive electric railway system has been long in use, the almost constant removal of pavement along some part of the tracks for purposes of re-bonding is a matter of common observation. The expense of city paving is often so great that the actual re-bonding, after the ends of the rail are uncovered, costs only a fraction of the sum that must be expended to remove and replace the pavement.

Bonds to reduce the electrical resistance between rails at their joints are required by

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the general use of the track as a large part of, or in many cases the only metallic conductor, except underground pipes, between the cars and power stations. The object of using the bonded rails as a return conductor is, of course, to avoid the expense of wires for that purpose.

The nature and location of the joints between the steel rails and the copper bond wires are such that these joints are subject to a constant and rapid deterioration by oxidation, due to the action of the liquids of the soil. As this deterioration of the rail and bond joints begins almost as soon as they are made, the resistance of the track circuit, to which the resistance of a return cable is assumed to be equal for comparison, should be the average resistance of the track during the time that one set of bond connections remains in use.

Where the rail bonds are not used, each rail must be connected directly to a return cable. A very important difference exists between the ampere flow from rail to rail through bonds and the amperes that pass from a single rail to the return cable, where bonds are not used and each rail is connected to the return. Where the bonded rails constitute the only return path for the current, the joints for each rail length of the track must carry the total number of amperes for all of the cars more distant than the joints in question from the power station on that particular track. Moreover, this flow of current through any set of the bonded joints continues so long as there are any cars more distant from the station than the joints. In city streets the current from a score or more of cars may pass through a long train of joints at rail ends.

Quite different is the case for joints between the individual rails and their common return wire, where the joints for each pair of rails must transmit the current of one, or at most, two cars. The current flows across these joints from each pair of rails to the return wire only when one or more cars are on that particular pair of rails. A rail weighing seventy pounds per yard of length has an area in cross-section of very nearly seven square inches. The electrical resistance of iron and steel per unit of length and area is about seven times as great as that of copper, so that a steel rail with a seven-inch section has nearly the same resistance per foot or mile as a copper wire with an area of one square inch. As two rails are present for every track, their combined conductivity, for the weight of seventy pounds per yard, is equal to that of a copper cable with a sectional area of two square inches.

Considering a track one mile in length, laid with rails each weighing seventy pounds to the yard, and equal in resistance to a copper cable of the same length and with a cross-section of two square inches, this resistance would be .022 ohm for the rails alone, without any allowance for the joints or the copper bonds. In a single line one mile long there are 176 rails, when each has a length of thirty feet. Every rail is joined to one or more bonds at each end, so that there are at least 352 joints per mile of single rail. The resistance of each joint between a bond and rail is subject to great variations, partly from the way it is made, but to a much greater extent according to the time the joint has been in service.

The resistance of the bond joints at each end of a rail is dependent upon the surface and character of the bond contact, as well as upon the time it has been in use. Where the number of cars passing over the track is comparatively large, it is quite common to use two copper bonds at each rail joint, each bond having a section not smaller than that of a number 0000 copper wire. These bonds vary in length according to their particular style and make, but two feet for each may be taken as a medium figure. As there are 352 rail joints per mile of single track, two bonds per joint and two feet per bond bring the total length up to 1,408 feet of bonds per mile. Considering the bonds as a conductor through which the current passes that goes from rail to rail, the total length of this conductor per mile of track is evidently 352 feet, and its cross-section equal to that of four number 0000 wires. The resistance of a copper wire equal to four number 0000 in section and 352 feet long is .0044 ohm, or about one-fifth of that found for the conductor formed by the rails alone in a mile of single track.

Taking the resistance at .001 ohm for the joint or contact between one end of a number 0000 copper bond and a steel rail, two and a half years after the joint has been made, the resistance for both joints made by the ends of the bond is .002 ohm. As a line of rails of the thirty-foot length has at least 176 bonds, the resistance of the joints made by these 176 bonds with the rails is .352 ohm.

The resistance of the joints between bonds and rails for this mile of single track is, therefore, only one-fourth of that of the joints for a single line of bonds, and is .088 ohm. As the resistance of the rails themselves in a mile of single track was found above to be .022 ohm, and the resistance of the bonds .004 ohm, the total resistance of

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one mile of single track, laid with seventy-pound rails and bonded with two number 0000 bonds per joint, is a little more than .114 ohm.

A copper return wire, with a resistance per mile equal to that of the bonded track, should now be selected in order to compare its cost with that of bonding the rails. The weight of a bare copper wire one mile long, and with a resistance of .114 ohm, is about 7,800 pounds. At a price of fifteen cents per pound, the cost of this return wire, with a resistance equal to that of the complete track, is $1,170. The return wire should be connected to each rail at one point, and about five feet of wire will serve to make one connection to each of a single pair of rails. Five feet of wire to join the main return and the track is therefore necessary for each pair of rails, or 880 feet per mile of single track. As the current to be transmitted from each pair of rails to the copper return cable is only that for one, or at most two, cars, a wire of No. 1 B & S gauge is ample for the purpose, and in fact so large a size is only desirable to resist the action of corrosion and of mechanical strains.

With the proposed connections between the track and the return cable, the current from each pair of rails has a path over two No. 1 wires to the return. The weight of 880 feet of No. 1 bare copper wire is 212 pounds, which, at 15 cents per pound, costs $132. The total cost of the copper return and its connections in this case is thus $1,302.

Again, with the return cable connected to each rail, the current from any car crosses only one joint, or break, between steel and copper, though this joint may be divided into two parts, each of which takes a part of the current as shown. On the other hand, where bonded rails serve as the return conductor, the current from each of a large number of cars may often have to pass along several miles of track in its flow from them to the power station. Each mile of track presents 352 joints or breaks between the steel rails and copper bonds in what is known as series with each other, that is, so arranged that the current flowing must traverse them in succession, one after another. Where the current from ten cars flows along three miles of track, the fall of pressure due to the resistance of the bond joints is $\frac{352\times3\times10}{2}$=5,280 times as great from one end to the other, as is the fall of pressure where the current of one car flows through the two connections of a single pair of rails to the return cable, all individual connections having the same resistance.

For a car that takes fifty amperes of current, the drop of pressure at the joint between the rails and the return cable is only $(50\times.001) \div 2 = .025$ volt, an amount too small to be of practical importance, the resistance of each joint between the copper and steel being taken at .001 ohm as before. Each mile of single track, double bonded and with each bond joint at .001 ohm resistance, would have a total drop at the joints alone of $500\times.088=44$ volts, when the current of ten cars, taking fifty amperes each was flowing, or 132 volts drop for three miles. One mile of single track double bonded, requires $176\times2\times2=704$ bonds. Holes must be drilled for the bonds, to the number of four in each rail or 1,408 for the mile of track. If the cost of drilling the holes and firing the bonds be taken at 50 cents per hole, the expense for the labor of bonding is $704 per mile of single track. The 352 rail joints per mile require 704 bonds and these bonds of No. 0000 wire, each two feet in length, weigh 901 pounds. These copper bonds at 20 cents per pound cost $180.20, making the total expense of double bonding one mile of single track $884.20 for both bonds and labor.

The expense for labor to drill the rails and to connect and place the return wire, may be taken at fifty cents per hole, as in the case of bonds, and since there is only one hole per rail, or 352 per mile of single track, the labor charge is $176 for this length. As the cost of a copper return cable with a resistance equal to that of a single track of 70 pound rails, double bonded, was found above to be $1,170 per mile, and the cost of short wires from rails to return cable $132, the total labor and material in connection with the return cable cost $1,478.

To repair bond connections, a section of the street pavement must be taken up at each rail joint, an operation far from uncommon in city streets. One square yard of paving seems a fair estimate of the average amount of paving commonly removed at each rail joint, where the bond connections are to be repaired. Granite blocks on a concrete base are a common form of paving, especially along street car tracks, and are here used as the basis of the estimate. A fair price for such paving is three dollars per square yard, when done in large amounts. The cost of repaving at a number of detached points is obviously greater per square yard than that where the work is continuous in

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extent, and the cost to remove the paving is, perhaps, one-half of the sum necessary to put it down. On the other hand, it is often unnecessary to remove the concrete foundation where granite blocks are taken up for the repair of bond connections.

Considering these several factors, it seems that the cost to remove and replace the square yard of granite paving at each joint must be as much as $3. To remove the bonds, clean the contact surfaces, ream out the holes in rails and make the new connections may readily cost as much as the original placing of the bonds, or 50 cents per connection as above estimated. As there are 352 rail joints per mile of single track, the estimated expense of removing and replacing the pavement amounts to $1,056 for that distance. This expense on pavements should be added to the cost of rebonding to determine the total expense to maintain bond connections during the period through which the first set of bond connections is used. What the period should be during which a single set of bond connections is retained in use is an open question, but it is here taken at five years, or twice the period during which bond connections were assumed to have risen to a resistance of .001 ohm each. The total cost for the repairs of bonding, under the conditions stated, is thus $704+$1,056=$1,760 during the first five years and a like amount during each subsequent five years, except that the cost of the copper bonds may be saved for the second five years if the original ones are not too much deteriorated. If bond connections may remain in use five years, it is reasonable to assume that the connections to a common return cable may serve during ten years, because of the trifling amount of current that passes through each of them, in comparison with that flowing through bond connections. One-half square yard of paving should be all whose removal is necessary to allow access to the single connection of the return cable to each rail, amounting to 176 square yards per mile of single track. At $3 per square yard as before, the cost to remove and replace this amount of paving is $528. As this expense comes only once in ten years, one-half of it, or $264, should be charged to the first five years of operation.

In a case for which the above assumptions hold good, the first cost of double bonding one mile of single track, laid with rails weighing seventy pounds per yard, is $884.20 for the bonds and the labor of placing them, while the first cost of a copper return cable of a resistance equal to that of the rails, bonds and bond connections combined, after two and a half years, is $1,478, when laid and connected for an equal distance. On the other hand, the sum of $1,760 must be expended on the bonded system every five years to maintain its average resistance at that of the copper return cable, while only $176+$528=$704 is required to maintain the copper return cable for ten years, or neglecting interest, $352 for five years. On this basis, the first cost and maintenance of the bonds at the end of the first period of five years is $2,644.20, and the like cost for the return cable $1,830. As time goes on, the total charges against the bonded system tend constantly to a still greater excess over the total expense on the return cable. The assumption of .001 ohm as the resistance of contact between the end of a 4-0 bond and its rail, after two and one-half years of use, is probably too high for some cases and too low in others. For double bonded rails the resistance of .001 ohm for each bond connection gives a total contact resistance at each rail joint of (.001×2)÷2=.001 ohm. With 500 amperes flowing along a single track—that is, 250 amperes through each line of rails, the resistance of .001 ohm for the bond contacts at each rail joint involves a drop of 250×.001=.25 volts from one rail end to the connecting end neglecting the resistance of the bonds themselves, and an energy loss of 250×.25=62.5 watts. These figures are less than have been noted in some instances.

MADISON, WIS., WATER SUPPLY.

The city of Madison, Wis., derives its water supply from artesian wells, and has, after continued experiment, developed a system which furnishes a sufficient supply of pure water of good quality for all domestic uses. The cost of the supply has been very nearly equal to the estimated cost of taking water from the lake on which the city is located, and the supply is much more satisfactory, so that undoubtedly the number of consumers is greater and the revenue is therefore greater than if the other source had been chosen.

During the progress of the development of the supply there came a time when the available supply threatened to be insuffi-

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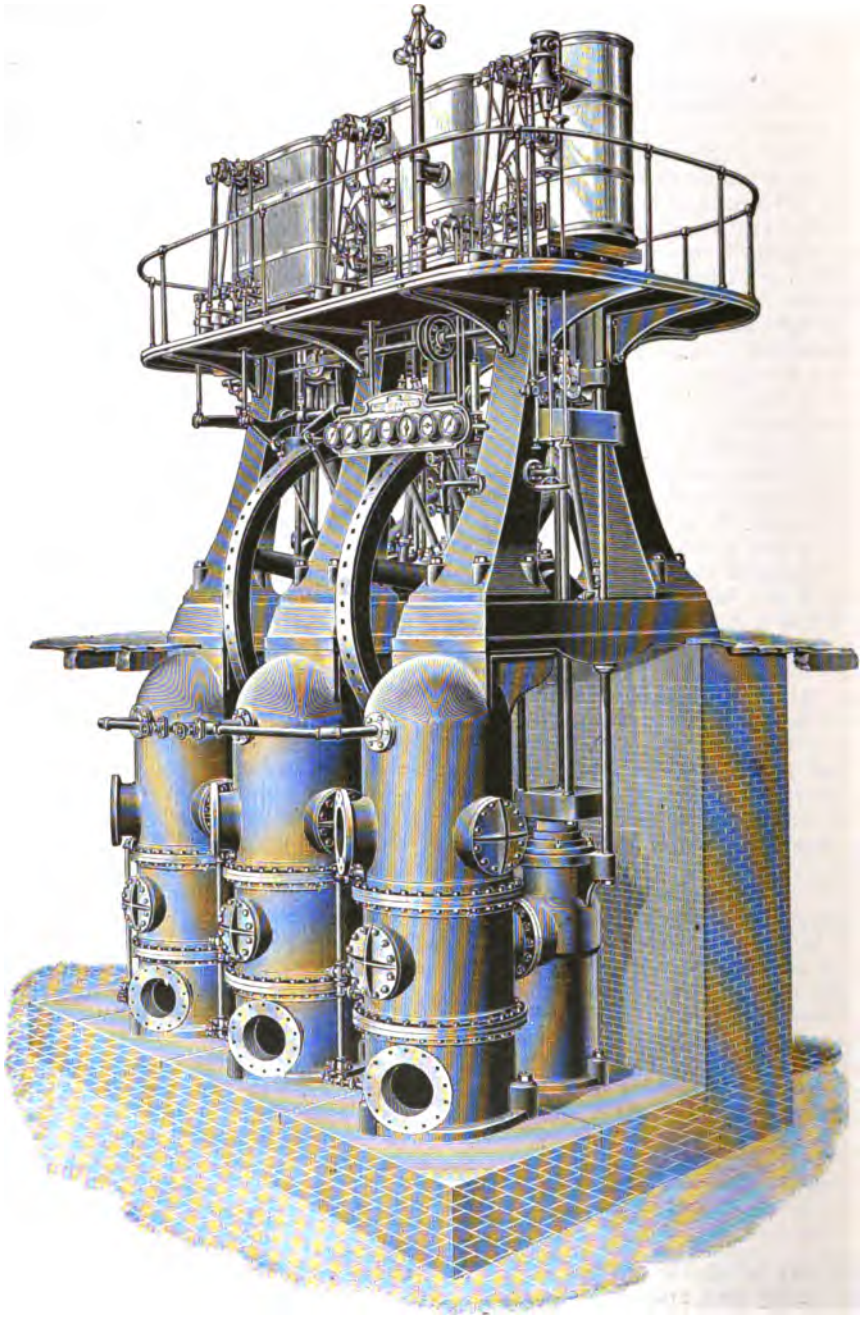

VIII. NEW 3,000,000 GALLON PUMP, MADISON, WIS., WATER-WORKS.

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IX. PUMPING STATION, MADISON, WIS., WATER-WORKS.

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cient for the demand. Not wishing to resort to the lake, the water commissioners decided to reduce the waste of water by applying meters to services, although the citizens generally were strongly opposed to this step. The results have been so satisfactory, both to the water commissioners and to the consumers, that Madison is a prominent example of the benefits of the water meter system.

In the last annual report, the superintendent, John B. Heim, gives the computation by which he shows that the saving in coal for pumping engines on the basis of the saving in pumpage at the time of the introduction of meters, twelve years ago, has been more than sufficient to pay the cost of installing the meters. Profits may be computed arising from the saving in amount of water to be pumped, which, if not made, would have required large additions to the supply and to the pumping plant, with the consequent increase in interest charges and in daily cost of operating the pumping station. The present consumption of water, based on the pumpage and the census population is 43⅔ gallons per capita. Over 86 per cent. of the population is served with water, so that this figure is not too small when compared with the conditions in other cities, and is a fair measure of the legitimate consumption in small residence cities. The actual consumption per capita for the 2,586 takers of water with meters, counting 6 consumers to each meter, is 19¾ gallons a day. The difference between this rate and the rate for the whole city is accounted for by the increase in consumption through the 172 taps not metered, the extinguishing of fires, free water and flushing of mains, leaks and laying of new mains. About three-quarters is attributed to free water. More than two-fifths of the water-takers pay the minimum rate of $4.50 a year. Meter repairs for the year amounted to only $68.25. But 135 taps are now unmetered.

A comparison of Madison, population 19,164, nearly all taps metered, with La Crosse, population 28,900, no meters, is made, which shows the advantages of the meter system to both consumers and water supply.

Thus La Crosse paid $11.20 per million gallons, expense of supplying water, and received $15.60 per million gallons, the net earnings amounting to $4.40 per million gallons. Madison paid $38.40 per million gallons, including extra expense from required use of hard coal and operation of meter system, and received $84.30, the net earnings amounting to $45.90 per million gallons. Many items in the cost of supplying water are the same for larger or smaller amounts supplied, so that the cost per million gallons will always be found greater for the works with the smaller consumption, other conditions being equal.

The average water rent collected per taker per annum was $9.37 in Madison and $10.23 in La Crosse, showing a saving to the consumer in Madison of nearly 10 per cent.

If the same estimate of six consumers per tap is used in both cities, about 86 per cent. of Madison's inhabitants are supplied with water and but 65 per cent. of those in La Crosse. This indicates that the meter system does not deter the taking of water by inhabitants, but rather encourages it.

A new three-million gallon triple-expansion Reynolds pumping engine has just been installed in an addition to the pumping-station. The accompanying illustrations show the pump and the water-works building before the addition was made. The extension of the pump-room is to the left in the view and in the same style. See Plates VIII and IX.

It should be suggested that the water consumers are not getting their full share of the benefits of the meter system. Judging from the last report the works can pay all expenses, about $8,000 a year for new construction, and $5,000 a year on the bonded debt, which now amounts to but $18,000, and without any assistance from the city. More than half the water pumped is estimated as free water, nearly all of which is for city purposes. It is hardly justice to water consumers to require them to pay for twice as much water as they use, that the city may receive its supply free. It is true that most of the water consumers would be called upon to pay their share of the amount charged against the city, but this amount would be assessed upon an entirely different basis and would be distributed in quite a different ratio from that of water consumption, and many not now paying their due share for fire protection and other public uses, would pay their just proportion of the cost of furnishing water. A large part of the argument with the consumer in favor of meters is lost if he loses his share of the financial benefit of their introduction by paying for water properly chargeable elsewhere.

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CONCRETE STREET PAVEMENT IN NEW ORLEANS.

Canal street is the principal business street of New Orleans, and is one of the widest streets in any city in the country. Its width between property lines is 170 feet. On each side is a sidewalk 18 feet wide, these sidewalks being covered in front of many business houses by permanent awnings or verandahs, as shown in the accompanying illustrations. Adjoining the sidewalks are roadways, each 37 feet wide. This leaves a space of 60 feet in the center of the street which is termed neutral ground. The tracks of the several street railroads are located in this space.

Mayor Paul Capdeville and the city council decided to put this unpaved neutral ground into a condition which would be a credit to the design of the street, and decided upon plans which were prepared by the city engineer, Capt. W. H. Hardee, for paving it with cement concrete. A plan for a rearrangement of the street railway tracks was included in the plan for the work, and the street railway companies have co-operated by relaying their tracks in permanent form. The character of the work done by them is shown in the accompanying illustrations. Concrete is placed under the railway tracks and between the ties, extending to the bottom of the ties. See Plate X.

After completion of the foundation and railway tracks to a grade five inches below the finished surface, a layer of concrete four inches thick, made of one part Atlas Portland cement, three parts of sand and seven parts of stone, is put in place and covered by a surface layer one inch thick, with proportions of one part of Hemmoor Portland cement and one part of sand. This specification corresponds with the ordinary specification for cement sidewalks. See Plate XI showing work of laying concrete.

X. NEW ORLEANS CONCRETE STREET PAVEMENT. RAILWAY WORK.

Sand joints are used in the concrete which correspond in location with tar paper joints in the wearing surface. These joints show clearly in the accompanying illustration of the finished pavement. Plate XII.

Between and next to the rails, eight-inch sand-joints are made, as shown in the illustration, for the purpose of preventing spreading of fractures which may develop from vibration of rails. These joints should make easy the work of repair along the rails, which will undoubtedly develop after a time.

Special catch-basins are used to drain the railway tracks, placed at intervals as required, and connected with the drainage canal under the roadway.

Bids were received and work began on the contract in November, 1900, and it was

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XI. NEW ORLEANS CONCRETE STREET PAVEMENT. LAYING CONCRETE.

XII. NEW ORLEANS CONCRETE STREET PAVEMENT. FINISHED SURFACE.

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pushed to completion this spring. The entire work includes fifteen blocks in length, or 22,000 square yards, and the contract price is $50,000, which is $2.27 a square yard or 25 cents a square foot.

McKelvey concrete mixers were used, run by electric motors, getting their power from the overhead trolley wires.

We are indebted to John McCoy, the contractor for the improvement, for the information and the accompanying illustrations.

EDITORIAL COMMENT.

Public Works and Methods.

Some observations made during a recent visit to Erie, Pa., give opportunity for comparisons of methods of controlling public works which may be of interest to our readers.

The general legislative and executive direction of public work in the city is vested in the common and select councils and the mayor, the councils having immediate control of all details, which must be carried out by the city's employes according to their direction, and the mayor having simply a power to veto measures not satisfactory to him.

The water-works system, however, is an independent organization, consisting of three members, one appointed each year by the judges of the local courts, whose only apparent connection with the councils and mayor is an annual report of operations.

The difference in the character of the management in the past is clearly seen in the difference in character of the plans upon which work has been constructed.

For example, sewers are directly under the control of the city council, which has the power to modify at will plans prepared by the engineering department without reference to the principles of design and construction essential for adequate and economical treatment. The consequence has been that the sewer system has grown up without plan, contains many sewers which are inadequate for the duty required of them, has cost more than a properly designed system, and must be supplemented and in part reconstructed at considerable additional and unnecessary expense. All these sewers in the central and larger part of the city discharge into a small stream flowing through the city and discharging into Presque Isle Bay (Erie harbor), from the opposite side of which the city draws its water supply. This method of disposal has created a nuisance which it is now necessary to abate. The present councils, with more foresight than their predecessors, have recognized the necessity of careful study of this problem under expert guidance by a comparatively small and compact body of persons with time and ability to consider it in detail and have delegated this duty to a commission of three members and appropriated to its use the money necessary for the preliminary studies.

This places the question upon practically the same basis for the present purposes as the control of the water-works and promises to secure the same exceilent results. For the court in appointing members of the water-works commission is careful to select citizens of special qualifications in mechanical and civil engineering and in business management, who are fully competent to guide the course of the department. The result is a water-works plant which keeps fully abreast of the requirements of the city, but does not expend money unnecessarily to gratify the ambitions of individuals to make a fine showing, and which is always looking to the needs of the future in regard to preservation of the purity of the supply, new machinery and extensions of service, and an administrative office which is a model of compactness, clearness and economy of operation, and from which any desired information can be secured at any moment. Further detailed account of this department will be given in an article in an early number.

Comparisons of the methods of administering the municipal affairs in different cities are common, but it is not often that it is possible to compare different methods of conducting the operations of the same city, which require expert engineering direction. The contrast is all the more clearly marked when it can be made on work so closely allied, and the course of the present councils in recognizing the benefits of concentration of responsibility and delegation of technical questions to persons of special qualifications for the direction of their study is much to be commended. An extension of the application of the principle over the construction of sewers and streets and the departments of street cleaning and garbage disposal is the logical sequence.

One of the most important results of expert direction of public work is the saving

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in cost due to proper plans, economical construction, and reduction in amount of repairs. The waste prevalent in the administration of city affairs is one of the last remaining prominent examples of the waste so prevalent in new countries where the abundance of materials in proportion to the labor available and to the consumers makes economy often more expensive than waste. As the country has filled up, the habits of waste have gradually been broken, until but few of them are left, those belonging to the community at large being more difficult to change than those of individuals. Economies must soon be introduced to compensate for the many new expenses developing, and in the increasing tax rates and the increasing demands for luxuries of city life, which are becoming necessities, will finally be found a force sufficient to bring about the necessary reforms in administration of municipal affairs.

Uniform Municipal Statistics. A little progress is reported in the movement toward uniformity in reporting of municipal operations. The National Municipal League at its recent meeting in Rochester devoted one afternoon to the subject, receiving the report of its committee on the subject and listening to a discussion upon public control of municipal accounting and statistics in this country and in Europe and the conditions in various cities. On the morning after the convention a conference of committees on the subject appointed by various societies was held and encouraging reports of the progress toward uniformity were made.

One of the most encouraging signs of progress is the preparation of a "Summary Statement of Receipts and Expenses of the City of Newton, Mass., for the Year 1900," which was prepared by Harvey S. Chase, a member of the Committee on Uniform Municipal Accounting of the National Municipal League. This has been printed as an appendix to the report by the city auditor to the board of aldermen, and takes the place of the regular annual examination of the municipal accounts by expert accountants, the usual verification of accounts being secured at much less cost in the process of rearrangement of data for the summary. It is a summary of the receipts and expenditures in all the departments of the city government, prepared upon the tentative form suggested by the committee, of which Mr. Chase is a member.

As such a summary and as a guide to the proper classification of accounts it is very satisfactory. The city of Newton is large enough to have entries under practically every head likely to be useful in a city, so that the Newton city statement will be a most useful guide to other cities in properly establishing accounts and making reports according to the committee's schedule. It will also serve to point out the places where modifications are advisable. The items under each department are entered in columns of ordinary or maintenance accounts and extraordinary or capital accounts. There are two columns of totals, one giving the total of expenditures for the division of city government, public works for example; and the other the totals for each class of expenditures under the departments, such as administration expenses, opening and grading streets, street paving, etc., under public works. For the student of the details of public works expenditures, this form must be supplemented in the reports of the city engineer or board of public works or other similar official, by detailed schedules like those presented by the American Society of Municipal Improvements for water supply, street paving, sewers, etc., and by similar detailed statements in the reports of other heads of departments. This auditor's or comptroller's summary properly presents the totals of such reports, the details belonging to the reports of the heads of the various departments.

No statement is made by Mr. Chase of the difficulties he found in making up the summary from the accounts of the city in their present shape, nor how much change would be necessary to put the account and record books into shape to take off the totals directly. This statement would be of value in a discussion of the tentative schedule, although it is impossible to make any schedule which will exactly fit the procedure of more than one city at a time. Expert public accountants must be depended upon to make the schedules according to their experience with various cities, and municipal forms of report must be modified to fit. It is understood that the form described has been so prepared.

Economy of Municipal Street Lighting. The state of Illinois permits the ownership of street lighting plants by cities, but does not permit such plants to furnish lights for commercial purposes. A number of cities have availed themselves of the privilege with greater or less economy, some in independent plants and some in combination with the municipal water-works. One of the cities which has installed an inde-

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pendent plant is Chicago, which began in 1888 with 192 lights, and operated 3,867 lights in 1900. The existence for much of the time of contracts with private plants for street lighting of districts not reached by the city's plant, makes easy a comparison of the relative cost of municipal operation and street lighting by contract. Such a comparison on a somewhat novel basis is made in the last report of Edward B. Ellicott, the city electrician.

The first thing noticed in the tables of results is the statement that in 1888 the city paid $200 per lamp on contract; in 1889, $185 was paid; in 1890–1–2, $175; in 1893, $156.25; in 1894–5–6–7, $137.50, and in 1898–9, 1900, $105 for part and $137.50 for part, the proportion of city lights which would have been paid for at the lower price if let by contract rapidly increasing from 16 per cent. in 1898 to 55 per cent. in 1900. The number of contract lights paid for each year is not stated, and the saving upon these lights by reason of the reduction in price has not been included in the statement of benefits. If the number of contract lights is large, as must have been the case for much of the time, a large part of this saving should be credited to the existence of the municipal lighting plant.

The city's indebtedness is so near the constitutional limit that it has been impossible to borrow money with which to construct a plant, and it has been necessary, therefore, for the city to proceed only so rapidly as available money came into the city treasury from annual taxes, also subject to a constitutional limit. The amount saved each year on lighting contracts was always available and some additional money has been appropriated each year. The amounts which would have been paid on lighting contracts, and which have been available for the municipal plant, have varied from $38,400 in 1888 to $458,021 in 1900. The amounts expended in the operation, renewal and extension of the plant have varied from $39,976 in 1887 to $433,524 in 1900. The total amount expended upon the plant in excess of the amount which would have been spent for contract lights (using the ruling prices each year), for the entire time of operation of the plant is $278,989. This is the actual extra cost to the city over what the lights would have cost by contract. Mr. Ellicott adds the interest at 4½ per cent. on the balance of this excess each year, counting it as a capital investment. This interest amounts to $189,961, and, added to the excess cost, makes $468,951 as the total of what may be called the capital investment for the plant, as it is what may be considered to be the investment above the annual expense under the contract system. The city has to show for this investment a plant which inventories at $1,350,000, and on Mr. Ellicott's conservative estimates could not be replaced at present prices for $921,000.

Large investments have been made in the last three years, and there are nearly three times as many lights in use as in 1897. Notwithstanding the larger investments of the past three years there has been a saving over contract prices for 1899 of $8,258, and for 1900 of $24,497.. The yearly balance of excess of cost is thus diminishing, and promises soon to disappear.

Flow of Water in Pipes.

One of the most scientific and valuable series of experiments upon the flow of water was made in 1898 and 1899 by Gardner S. Williams, Clarence W. Hubbell, George H. Fenkell and their associates in Detroit.

The purpose of the investigation was to determine the effect of curvature upon the flow of water in closed circular conduits under pressure, and particularly to examine the effect of changes in radius of curvature upon the losses of head in those cases occurring in ordinary water-works distribution systems.

The results have just appeared in advance of their presentation on September 4, 1901, before the American Society of Civil Engineers, according to the custom of that society.

Some of the results are diametrically opposed to the teachings of books on hydraulics heretofore, and some of them aid greatly in explanation of some poorly understood phenomena. The most striking result is that curves of short radius, down to about two and one-half diameters of the pipe, offer less resistance to the flow of water than those of longer radius, a result which is so opposed to former ideas that it is entirely unexpected. The observations throw much light upon the distances to which disturbances of flow extend, showing that they are transferred considerable distances from the curve or other source of disturbance. This effect is carried farther for slower velocities and results in variations in pressure at different points in the same cross-section under some conditions. Slight curvature has appreciable effect, and careful alignment of pipe both horizontally and vertically is shown to be as desirable for maximum capacity of discharge as is smoothness of inner surface.

Experiments were made upon 12-inch, 16-

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inch and 30-inch pipe, and the results when corrected for irregularities due to gates and other obstructions are in reasonable accord. Several new pieces of apparatus were invented and modifications of older apparatus made to suit the requirements of the work. The methods of conducting the investigation and of presenting the report are deserving of high praise. Further notice will be made of the work and of the discussion by members of the society and others which will undoubtedly follow the formal presentation of the paper.

Fixing Water Rates. An interesting decision upon the power of cities to regulate water rates, and the limitations of that power, has just been rendered by Judge W. N. Treichler in the district court of Linn county, Iowa, in the case of the Cedar Rapids Water Company v. the City of Cedar Rapids, Iowa, et al. in equity. The suit was brought to restrain the enforcement of an ordinance regulating rates to be charged by water-works companies for furnishing water to private consumers, the rates being considered too low. The ordinance took this wording in its title because the franchise period of the present water company has expired and its continued right to furnish water is somewhat in question.

The decision states "that the city has the right, under the statutes of this state, to establish rates to be charged by water companies is not disputed," but it also states that "the rates fixed by the ordinance are unreasonable and can not therefore be sustained."

The process by which this latter decision is reached is of much interest. In many cases the capitalization of water companies, including stock and bonds, is out of all proportion to the money actually invested, so that rates are kept unduly high to pay interest on the over-capitalization. This feature does not appear in the present case. The unreasonableness of the rates is based upon the actual value of the works as they exist at present. Each side of the case presented expert witnesses of national reputation, who testified to their estimates of value of the works. These estimates varied from $319,871 to $464,605. In determining the most probable value from these various estimates the court carefully compares them, making corrections to reduce them to the same basis, finally reducing the variation to the comparatively small difference of $15,000, with the maximum estimate practically $400,000. When interest items during estimated time of construction and cost of new work in progress are added to the lowest of the corrected estimates it becomes $427,000. A period of forty years is allowed for complete renewal of the plant, and the annual contribution to this renewal fund is computed as $3,500. The operating expenses are taken from the books of the company at $28,125.52, making the annual charges $31,625.52. The estimates of revenues from private consumers and the city under the new rates vary from $44,500 to $48,800, leaving $12,900 in the one case and $17,200 in the other case available for contingencies and for dividends on the money actually invested—about 3 per cent. under the first estimate and 4 per cent. under the second. This is considered to be too low a rate of interest for the character of the investment, and the schedule of rates is therefore not approved.

The principle upon which the decision is based is undoubtedly correct. The water consumers should pay the running expenses and the renewal expenses and a fair interest upon the constant investment of actual capital. There may be great differences of opinion regarding the estimates of cost of the works, as is shown by the evidence, and they must be equalized by the jury or by the court, as in this case. Another point upon which there may be great differences of opinion is the cost of operation. In fixing rates a legitimate sum must be determined upon. Expenditures for illegitimate purposes or errors due to bad management should be eliminated, the first for obvious reasons, and the second because the investors should pay the penalty of such error rather than the water consumers. Again, there is very large room for difference of opinion regarding the probable revenue from a new set of rates. Such revenues are almost always underestimated, the effect of lowering rates in increasing consumption being underestimated. There are no statements in the court's decision which give the detail of either of these sums. It is quite possible, however, that a swelling of the expense item and an underestimate of the increase in business have been made which together would bring the balance available for dividends up to the court's judgment of what is proper.

It is good business policy to reduce rates gradually, that embarrassment may not result from errors in judgment, and, the right to fix reasonable rates being established, the city can make further reductions hereafter.

Municipal control of public service corporations, or at least publicity of the ac-

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counts of such public servants, would be of much assistance in preventing the manipulation of accounts or the payment of money for purposes of concealment, or in undue amounts that the net balance may be kept low enough to prevent the lowering of rates which should properly be made.

Another similar case is reported from Oakland, California, in which over-capitalization is quite possible, no adequate amount of evidence apparently having been taken to prove that $7,000,000 is the actual value of the plant as it exists or is the sum for which it could be replaced at this time. Any difference between this actual value and the capitalization, stock and bonds, is due to the franchise right granted by the city and belongs properly to the city and its citizens. The procedure in the Iowa case recognizes this fact. It is suspected that the California decision has ignored it.

Patents and Sewage Purification.

The popular septic or natural methods of sewage purification seem to be passing through a stage of attack by claimants of patents similar to that passed through by the chemical processes during their early history in this country. The grounds for these claims seem to be equally unstable, all the essential parts of the processes, and practically all of the valuable combinations of processes, having been in use for so many years that claims of patent are certainly not valid. As in the earlier contest, the valid claims reduce to those covering pieces of special apparatus doubtless convenient but seldom, if ever, essential, so that, while there are no court decisions upon the questions involved, it is the opinion of those who have considered the matter most thoroughly that suits for infringement of patents on the general principles of the processes can not be successfully maintained. Again, as in the earlier case, it is not probable that more than one or two such suits will be started, if any, for the conclusions to be drawn from results of earlier litigation are certainly against the holders of such patents.

A short paper by Leonard Metcalf on "The Antecedents of the Septic Tank," to be presented before the American Society of Civil Engineers, gives a short statement of the prominent examples of the use of such tanks separately or in combination with filters in various countries from 1852 to 1897, which will be valuable as a convenient reference in discussions of the subject. Several constructions similar to one of those described, which are located in New York, and one similar to that at Marlboro, Mass., constructed on plans of the writer in 1892, might be added to his list.

THE QUESTION DEPARTMENT.

RELATIVE MERITS OF BRICK AND BLOCK PAVEMENTS.

What are the relative merits of brick and blocks for our main business streets?

What method of construction would you suggest as the best for our streets, which are macadamized, and which I think have a good sub-base for brick pavement?

What kind of curb would you recommend?

Subscriber, Deadwood, S. D.

As to the relative merits of brick and block: The only difference, if properly manufactured, is in the size, brick usually being a little larger than 2x4x8 inches and block being somewhere about 3x4x9 inches. If made of the same material, the brick are easier burned, and so are sometimes more durable on this account. A well burned block is better than a brick of equal quality, because there are fewer joints to wear, and the roughening effect under wear is less noticeable; *i. e.*, the surface keeps nearer smooth for a longer time. If of equal quality the writer prefers block, but a good brick should be selected in preference to a poorly burned block. The street in front of this office building was laid in 1895 with block, and nearly all of it is still in excellent condition, with comparatively little evidence of wear. It is the principal wholesale street of Indianapolis, with double street car tracks.

As to the method of construction: For a first-class street in every respect, the description in the article by W. H. Tarrant, in the April number of MUNICIPAL ENGINEERING, gives the proper methods of construction. Your city probably does not need the concrete base, but otherwise the description will apply. In the "Current Information" department of the same number will be found the recommendations of the National Brick Manufacturers' Association for first-class streets, and also for those requiring less foundation. The latter fits your case, so far as it can be applied to your present foundation. Your main street probably has more crown than is advisable for a brick street. If you are not able to raise the bottoms of the gutters any you must cut off the center

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of the street to reduce the crown to about 6 or 7 inches. Probably both can be done to some extent. It is to be hoped that this will not make your macadam foundation too thin in the center of the street. In fixing the bottom of gutter, allowance must be made for the 4 inches of brick and at least 1½ inches of sand cushion under it.

A good hard Colorado sandstone curb should give excellent satisfaction. A well laid concrete curb is also good and may possibly be cheaper. Only the best Portland cement and the best of workmanship is permissible, however. Bloomington, Illinois, gets on fairly well without curb on some of its business streets, the sidewalk stones, if of natural stone, projecting, and forming a substitute for the curb. The appearance is not entirely satisfactory. Since their great fire some of these stone sidewalks have been replaced with cement walks, which have been formed along the edge into what is practically a curb.

ASPHALT AND COAL TAR PAINTS.

A floor laid two years ago in an electric power station is composed of coal tar, coal tar pitch and asphalt with sand. It needs to be painted black. Knowing that paint containing turpentine would be injurious, inquiry is made as to what paint should be used. Would liquid asphalt, such as is used in dipping pipes, answer?

Subscriber, Malone, N. Y.

Several of the manufacturers of asphalt and of coal tar products make paints which will answer the purpose desired. Addresses will be found in our advertising columns. Convenient reference may be made to the headings "asphalt and coal tar" in the classified business directory and to the alphabetical index to advertisers.

A paint must be used which will dry thoroughly or one which can be applied hot and will be solid at the temperatures to which the floor is subjected.

WHITE AND LIGHT GRAY CEMENTS.

I wish to ascertain the names of manufacturers making very finely powdered white and very light gray cements, and especially to locate the manufacture of magnesia cement, used in combination with other ingredients in making special forms of artificial stone.

N. B. Winter, Lexington, Ky.

A reference to the list of plaster manufacturers in the Directory of American Cement Industries and Hand-Book for Cement Users ($5) will show the names of a number of manufacturers of cements which can be used for the purposes mentioned. In the list of cement manufacturers will be found the names of manufacturers of pozzuolana or slag cements, some of which answer the description given. More detail regarding them is given in the chapter in the handbook giving descriptions of works and processes. To these lists may be added The Alden Speare's Sons Co., who make a cement with magnesia base for special purposes, which may or may not answer the purpose.

MAKERS OF GAS AND GASOLINE MOTORS.

Can you tell me where to find a list of the names of manufacturers of gas or gasoline motors or engines that can be used as motive power for freight and passenger car service?

Engineer, New Haven, Conn.

The Directory of American Cement Industries and Hand-Bank for Cement Users ($5), just issued from the press, contains in its directory of machinery and supplies for cement plants, and machinery and tools for cement users, a list of engine makers, in which will be found the names of most of the makers of this class of engines.

MAKERS OF CEMENT PIPES.

We beg to inquire whether you could give us the addresses of the makers of cement conduits, pipes and other cement specialties.

The Art Portland Cement Co., Sandusky, Ohio.

The list of contractors and other large users of cement in the Directory of American Cement Industries and Hand-Book for Cement Users ($5), contains the names of manufacturers of cement specialties in all parts of the country. There are too many of them to reproduce the list here. The book is just issued from the press.

PREVENTION OF ELECTROLYSIS.

Can you give any data in regard to the bill introduced at the last session of the Indiana legislature for the prevention of electrolysis? I would like, also, to learn what has been the result to the water pipes of Indianapolis from this cause.

H. L. Smith, Supt. Water Dept., Norfolk, Va.

A similar question from

John Johns, Dept. Public Works, San Francisco, Cal.

The bill was killed so soon after introduction that it was not printed and the original has not been seen. Mr. F. A. W. Davis, Superintendent of the Indianapolis Water Company, wrote a paper some time ago on the subject of electrolysis, and illustrated it with photographs of pipes which had been affected. He will probably send copies of the paper to interested persons asking for it, so long as his supply lasts.

CONDUITS FOR ELECTRIC WIRES.

Will you kindly furnish us a list of cities which have constructed conduits for electric wires?

J. C. Jackson, City Clerk, New Castle, Pa.

Baltimore is provided with conduits for electric wires. Erie, Pa., has conduits for

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low-tension wires and is considering the construction of additional conduits for high-tension services. Duluth, Minn., has plans for conduits for both high and low-tension wires. There are doubtless others, information concerning which we will publish if our readers will send it in. Indianapolis has two sets of low-tension conduits owned by telephone companies. Bloomington, Ill., has conduits for both high and low-tension wires laid with steam heating pipes as a condition of granting franchise for pipe lines.

MARLS AND CLAYS IN MICHIGAN.*

By Delos Fall, Sc. D., Albion College, Mich.

Portland cement is a chemical compound resulting from the burning, at a temperature of about 3,000 degrees Fahrenheit, of an intimate mixture of a certain definite proportion of pure limestone and clay of a definite condition and pure quality. The limestone may be of a solid and crystalline form or in a finely divided condition, in which it is found in the so-called marl beds of Michigan. The clay may be solid shale or the plastic variety that has resulted from the disintegration of the parent rock. What constitutes a pure quality for clays and marls, and what the proportion in which they are to be mixed, is a question which the chemist alone can determine. Indeed, it may be said that upon the chemist rests the whole responsibility of determining the feasibility of using certain raw materials as they are discovered in the preliminary explorations, and he alone can determine the exact proportions in which the raw materials shall be mixed to produce a compound which shall come within the limits of what is known as a true Portland cement. No two Portland cements, made from different raw materials, can have exactly the same proportion of their constituent ingredients, but all must closely approximate to the same proportion of each of the various constituents, or, failing to do this, the finished product would lack those properties which would make it a cement of high grade. The limits of the proportionate quantity of each constituent entering into the composition of a high grade Portland cement have been established theoretically, but in a better way by extended practical experiments, which workers in cement have made, both in this country and in Europe. The leading brands of Portland cement, whether made in the United States or in Europe, conform very closely to the following composition:

Silica, from 20 to 24 per cent.
Alumina, from 6 to 9 per cent.
Iron oxide, from 2½ to 5 per cent.
Lime, from 60 to 65 per cent.
Magnesia, from 0 to 3 per cent.
Sulphuric anhydride, from 0 to 2 per cent.

It is the purpose of this paper not so much to speak of the finished product as to give a few practical facts concerning the occurrence, nature, quality and quantity of the raw materials.

The term "marl," from the mineralogical standpoint, is a mixture in any proportion of limestone and clay. In certain parts of our country, notably in the southern states, but not to my knowledge in Michigan, this mixture approximates very closely to the proportion required for a high grade Portland cement. As the term is used with us it applies to a comparatively pure calcium with a certain very small proportion of clay, and it may contain a small percentage of magnesia and sulphuric acid. The marl found in Michigan is derived chiefly from the shells of animals, sometimes consisting almost entirely of shells more or less broken, but generally in a finely divided state. Deposits of marl are found in the beds of those lakes in Michigan which, owing to their past history, are now surrounded by marsh lands, the marl being found in the bottom of such lakes, and extending out under the overlying muck or peat. These beds vary in depth from a few inches at the edge of the deposit to thirty or forty feet in the center. In places they are almost entirely uncovered and are exposed to view in such a way that they can be immediately utilized without any expense for the stripping process, which must be employed in all cases where there is a covering of muck or peat. Occasionally it will be found that a layer of greater or less thickness is found, consisting of decayed organic matter lying in the center of the depth of the bed, indicating that in the process of the deposition of the marl the level has alternately risen and fallen. In some cases it has been found possible, by draining off the water of the lake, to uncover rich and extensive beds of marl with no other expense attached to this stage of the work. The composition of the marl in various beds in Michigan varies to a considerable extent. One bed which has been exhaustively examined gives on analysis, average of fifty samples, a composition as follows:

	Per Cent.
Silica	0.58
Alumina	0.76
Iron Oxide	Trace
Calcium Carbonate	94.76
Magnesium Carbonate	94.76
Sulphuric Anhydride	0.62
Organic Matter	3.09
Total	99.90

*A paper before the Michigan Engineers' Society.

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This is an extremely pure marl and is rarely found running so high in calcium carbonate and so low in clay, magnesia and sulphuric acid.

An average of eighty-four samples from another bed resulted in the following composition, which may be taken as fairly to represent the marls of Michigan:

	Per Cent.
Silica	2.08
Alumina	2.59
Calcium Carbonate	88.06
Iron Oxide	
Magnesium Carbonate	0.32
Sulphuric Anhydride	0.78
Organic Matter	5.30
Total	99.13

Exclusive of the organic matter the eighty-four samples average 93.10 per cent. of carbonate of lime.

The above bed is characterized by a strain of blue clay accompanying the marl. This is not a serious adulteration of the marl except that it will require more constant attention from the chemist in order to produce a mixture of constant composition.

The main points of interest concerning prospective value of marl for manufacturing purposes are the proportions existing in the raw material of carbonate of lime, magnesia, sulphuric acid and organic matter. It is desirable that the carbonate of lime should run as high as possible in order that there may be the largest percentage available of this, which is the most important contribution to the final composition of Portland cement. Too much organic matter will lower the percentage of carbonate of lime and clog the rotaries in the process of burning, and because of this fact will diminish the amount of the finished product which the rotary furnace is capable of producing per day. With excessive amount of organic matter present in the marl the total output of a sixty by six rotary furnace might be as low as 75 or 80 barrels per day, when, with the marl containing less organic matter, say from 2 to not more than 5 per cent., the product should be from 120 to 130 barrels per day.

The presence of magnesia in the cement must be considered deleterious to the quality of the cement, from the fact that it refuses to unite with the clay at the temperature required for the burning of the cement, and is left at the end of the process in the form of caustic magnesia, MgO. When water is added, it takes up that water to an extent which produces a hard product of increased volume and hence produces a cracking or disintegration of the proposed structure. In general, it may be said that a proportion of not more than 2 per cent. is not considered harmful. The presence of sulphuric acid in the marl and clay and its effect upon the finished product does not seem to be appreciated as it ought to be, for it is noticeable that most of the reports of chemists as to their analytical findings give no mention of sulphuric acid in the marl. The chemical analysis should always state the presence or absence of this ingredient, and the proportion in which it occurs. Sulphuric acid generally occurs in the form of calcium sulphate or gypsum, and it is well known that the presence of it in considerable percentage, say more than 2 per cent., retards the setting quality of the cement. At the same time it possesses no hydraulic qualities, but will, in the presence of water, partially dissolve and thus lead to the final disintegration of the proposed structure.

A word may be said with reference to the location of marl and clay beds, as to their accessibility by railroad or water transportation. From the fact that in making of cement there is required from three to five or six times as much marl as clay, and also that the marl contains a larger percentage of water than the clay, it is always advantageous to locate the mill near the marl beds. Everything being equal, everyone would say that a mill so established that water transportation can be utilized may reach a margin of profit above that located on or near a line of railroad. However, the settlement of such a problem can only be arrived at by careful weighing of all the questions entering into it.

Many of the beds of marl in Michigan are sandy, sand having been washed from the adjacent highlands to such an extent as to largely vitiate their value. And again, it is not well that clays should be present in marls in too large quantities. But this fact can be overcome by due watchfulness on the part of the chemist, after the mixture has been made up and before the burning has been done.

Originally it was supposed that the difficult problem for the initiation of a Portland cement industry was to discover sufficiently large beds of pure marl; indeed, it is true that that feature of the problem is not so easy a task as many suppose, the number of beds in Michigan being somewhat limited as to quantity, accessibility and quality. On the other hand it was supposed that an inexhaustible supply of clay of proper quality could be found adjacent to any marl bed. Farmers and others would point to large deposits of clay which they were sure would prove of sufficient purity and quality for the purpose. By this general tradition promoters and investors have been led into the establishment of large plants, only to find that they must seek long and sometimes unsuccessfully for clay of the proper material. Not all clay will make a good Portland cement.

Clay is essentially a silicate of alumina,

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but rarely occurs without the admixture of iron oxide, calcium carbonate or sulphate and sometimes magnesia. While calcium carbonate must be used in the mixture for cement making, its presence in the clay complicates to a large degree the problem of the chemist in making that mixture, and more especially in maintaining in the mixture a uniform and constant composition. Many of our clays run too high in alumina, making, upon burning, a quick setting cement, not so durable and permanent as that produced from a clay containing a less amount of alumina. The following analysis of a Michigan clay will aptly illustrate this point:

Silica	60.1
Alumina	20.73
Iron oxide	5.18
Lime	1.19
Magnesia	.44
Sulphuric anhydride	3.35
Loss on ignition	8.16
Total	99.15

This analysis illustrates another bad feature existing in some Michigan clays, namely: The too large percentage of sulphuric acid. The 3.35 per cent. of sulphuric acid in this clay represents 5.6 per cent. of calcium sulphate and this in the mixture with marl would bring the proportion very near to 2 per cent., which might be considered to be the limit permissible for that ingredient. The analysis above given would be almost ideal if the alumina ran from 6 to 10 per cent. and the sulphuric acid was lower or altogether absent.

Clay should contain very little free sand, iron oxide or organic matter. It should have a tendency to gelatinize when treated with acids. The silica must be combined and not free, for the reason that at the temperature at the command of the cement maker, free silica will not combine to form a silicate of lime, which is the essential ingredient in Portland cement. About 60 per cent. of the clay should be silica.

Three classes of clays found in Michigan are illustrated by the following analyses taken from my laboratory notebook:

	No. 1 Per Ct.	No. 2 Per Ct.	No. 3 Per Ct.
Silica	49.36	60.70	71.84
Alumina	10.30	20.92	15.53
Iron oxide	3.90	7.06	3.57
Cal. car.	31.01	.73	.75
Mag. car.	1.77	None	Trace
Sul. triox.	31.15	.60	1.24
Organic matter	1.00	9.89	5.68
	100.49	99.90	98.61

No. 1 possesses the great disadvantage of a variable quantity of calcium carbonate, The fact that the relation of this to the clay itself is a mere mixture growing out of accidental and therefore varying conditions, makes it very certain that no two samples of the same bed would show the same composition. The clay is also imperfect from the presence of a high percentage of calcium sulphate. The temperature at which proper calcination would take place can scarcely be inferred but it would probably be high.

Clay No. 2 is a good clay; it will burn at low temperature and be economical of fuel. It is rather high in alumina and would make a quick-setting cement. Its setting quality could be retarded by the addition of a small percentage of gypsum.

Clay No. 3 is too high in silica; the temperature required for calcination would necessarily be very high, the excessive temperature being hard to acquire and very disastrous to the life of the rotary.

MUNICIPAL MATTERS IN COURT.

[Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.]

Area Way Along Sidewalk—Where a deep area way along the line of the sidewalk on a busy street in a large city is insufficiently guarded, and has existed in such condition for a long period of time, the city is chargeable with knowledge of the damage. Donnelly vs. City of Rochester, 59 N. E. Rep. (N. Y.) 989.

Changing Grade—One petitioning for damages suffered by reason of the change of grade of a street is not entitled to recover where his damage, though greater in degree, is not different in kind from that sustained by the public generally. Davenport et al. vs. Inhabitants of Hyde Park, 59 N. E. Rep. (Mass.) 1030.

Defective Sidewalks—In an action against a municipality for injuries received by reason of a defective sidewalk, evidence that planks in the walk were rotten for some distance on either side of the place where the accident occurred is admissible to show that the city had notice of the bad condition of the walk. Vielleese vs. City of Green Bay, 85 N. W. Rep. (Wis.) 665.

Diversion of Water for Municipal Purposes—A city which has become a riparian owner on a navigable lake and on its non-navigable natural outlet has no right to divert the water of the lake for municipal purposes, and thus lessen the natural flowage of the water in such outlet, to the injury of a lower riparian owner and prior

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proprietor, without compensating him therefor. City of New Whatcom vs. Fairhaven Land company, 64 Pac. Rep. (Wash.) 735.

Failure to Furnish Water—A municipal corporation, owning and operating a system of waterworks erected by taxation and maintained by tolls and rents, is not liable to a patron of the waterworks, paying the usual rents, for the value of his property destroyed by fire, through the negligent failure of the city to furnish the water necessary to extinguish the fire. Butterworth vs. City of Henrietta, 61 S. W. Rep. (Tex.) 975.

Validity of Contract for Lighting—The power of a municipal corporation to contract for electric lighting being discretionary, and not legislative, no ordinance was necessary to authorize a contract for that purpose; hence, it was immaterial that an ordinance for such purpose was not published in a newspaper, as required by Burns' Rev. St. 1894, sec. 4,357, subd. 16. Town of Gosport vs. Pritchard et al., 59 N. E. Rep. (Ind.) 1058.

Irregular Contracts—Where a contract within the power of a public corporation is set aside for irregularity, there may be recovery, as on a quantum meruit, against such corporation for work and materials furnished under such contract before legal attack, irrespective of any benefit derived therefrom. In such a case, the recovery may include expenditure to secure such materials pending the proceedings attacking the contract. Wentink vs. Board of Chosen Freeholders of Passaic County, 48 At. Rep. (N. J.) 609.

Private Right of Access to Street—The right of access from a street by the owner of land abutting on such street is a property right, of which he cannot be deprived without compensation; and when a municipal corporation, in the exercise of the power conferred on it to grade and improve its streets, destroys or impairs such right, the corporation is liable to the owner in an action for damages. Mayor, etc., of City of Macon vs. Wing, 38 S. E. Rep. (Ga.) 392.

Advertisement for Bids Restricting Field—Advertisements for bids by the commissioners of the New East River Bridge properly restricted bids for work to parties having the requisite plant and facilities in successful operation for at least a year on work of a similar character, and required that the steel should contain specified elements, which, in the judgment of the commissioners, were best suited for the work, since the act prescribing their duties does not require them to advertise for bids or let their contracts to the lowest bidder. Meyers vs. City of New York, 69 N. Y. Supp. 529.

Sewer—Injury in Construction of—A sewer was dug under the supervision of the city street supervisor, assisted by the city engineer, who acted as foreman under him. The proof tended to show that the braces to prevent the sides of the sewer, which had been loosened by a rain, from falling in, were put in under the direct supervision and order of the foreman. Held, that a charge on "fellow servants" was correctly refused in an action for injuries caused by the caving in of the sewer. City of LaSalle vs. Kosta, 60 N. E. Rep. (Ill.) 72.

Obstruction by Wire Between Street and Sidewalk—It is the duty of the authorities of a city to keep and maintain the sidewalks thereof in a reasonably safe condition for public use, and this duty is not performed by keeping in such condition that part of the sidewalk only which is most generally used. Whether a wire stretched along the outer edge of a sidewalk, about four feet from the ground, and fastened to two poles, by contact with which the plaintiff was injured, was an obstruction to the safe use of the streets, was a question of fact for the jury to determine, under proper instructions from the judge. City Council of Augusta vs. Tharpe, 38 S. E. Rep. (Ga.) 389.

Negligent Laying of Water Mains.—A municipal corporation which is invested with power to construct a system of water works for the benefit of the city beyond its corporate limits, to accomplish which it has been specifically authorized to lay mains and pipes under and across public highways, is liable to one injured by the negligent execution of the power granted. (a) Such liability attaches not only as to the laying of the pipes, but to the negligent removal of them as well. (b) The act which it is alleged was so negligently done as to injure the plaintiff was not ultra vires, and the petition set out cause of action. City Council of Augusta vs. Mackey, 38 S. E. Rep. (Ga.) 339.

Pollution of Stream with Sewage.—Defendant built a sewer system with an outlet into a river just above plaintiff's farm. Plaintiff's house, which was 850 feet from the river, became almost uninhabitable at times because of the defilement of the river, and the water was rendered unfit for stock and bathing, and the value of plaintiff's property was decreased. Experts testified that the sewage could be deodorized and rendered unobjectionable by an expenditure of $5,000. Held, that the sewer as maintained constituted a nuisance, and plaintiff was entitled to an injunction restraining defendant from using the stream unless the sewage was first deodorized, since, in the absence of legislative authority, a city has no greater rights to pollute a navigable stream than a private individual. Winchell vs. City of Waukesha, 85 N. W. Rep. (Wis.) 668.

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Extra Work by Contractor.—Nashville City Charter, No. 43, provides that orders for alterations in the prosecution of any work can be made only by order of the board of public works, and that the order shall be of no effect until the price to be paid for the same shall have been agreed on in writing, and signed by the contractor, and approved by the board; and that the total cost of the work, with the addition of the price so agreed on, shall not exceed the original estimate. Sec. 44 declares that no contractor shall be allowed anything for extra work caused by any alteration, unless an order is made and signed as provided in the preceding section. Plaintiff contracted in writing with the board of public works for the construction of a city hall, and was ordered to make certain changes not included in the original contract, and notified the board in writing that he would demand extra compensation for such changes. Held, that no action can be maintained in any form to charge the city for the work so performed, since the defendant's charter expressly prohibited the allowance of anything on a contract which did not conform to the provisions of the charter. Watterson vs. Mayor, etc., of City of Nashville, 61 S. W. Rep. (Tenn.) 782.

CURRENT INFORMATION

Irrigation vs. Water Power Rights in Utah.

A decision was rendered by Judge Morse May 4 in the suit brought by Salt Lake City and the Utah and Salt Lake Canal company against the Salt Lake City Water and Electrical Power company, the North Jordan, South Jordan and East Jordan canal companies et al. The decision is favorable to the city and the canal companies; as they get practically what they contend for, while the power company gets very little. For the purpose of rendering the decree of the court effective, the court will appoint a suitable person to measure and direct the diversion of the water, and the court retains jurisdiction of the case for the purpose of making such orders and supplementary decrees as may be found necessary to render effectual the rights awarded in the decree and for the purpose in seasons of droughts of preserving the lives of live stock, orchards and permanent improvements, by making temporary redistribution of the waters. The injunctions asked for in the cases of Joseph Geoghegan, receiver of the power company vs. Salt Lake City and against the Utah & Salt Lake Canal company et al. are denied.

The power company will appeal to the supreme court from Judge Morse's decision.

Final Decision on Ogden, Utah, Water Rental.

The United States Court of Appeals at St. Louis, Mo., handed down two decisions April 20 in the Ogden Water Works case. Both decisions affirmed the decisions of Judge Marshall and the federal grand jury, reached over a year ago, and make it necessary for the city of Ogden to pay to the receiver of the water works company the sum of $35,000, which is the original amount of the water rents due and the interest that has accrued while the matter has been in litigation.

The official title of the case is Wm. C. Weaver, receiver for the Bear River Irrigation & Ogden Waterworks company, vs. the city of Ogden, Utah.

Ashland Must Pay Hydrant Rental.

In the case of the Ashland Water company vs. the city of Ashland, Wis., the city refused to pay certain hydrant rentals, the claim being made that the city did not have to pay the amount, as the water company had not extended its mains when ordered to do so by the city, and because pure water was not furnished as per contract. Judge Parish ruled that the impurity of the water did not make any difference in regard to the water used by the city for hydrant purposes.

Owensboro, Ky., Water Bonds Are Legal.

Judge Owen rendered a decision April 30 in the water works bond case at Owensboro, Ky. The suit is a friendly one between the city of Owensboro and City Clerk O'Bryan, for the purpose of validating the $200,000 bond issue to build new water works. The bond issue is being resisted by J. R. Lancaster, T. E. Birk and Z. T. Robinson, who sought to be made parties defendant, and recently filed a suit asking for an injunction to prevent the issue of the bonds.

Judge Owen grants the mandamus to compel City Clerk O'Bryan to sign the proposed bonds, and denies the intervening petition of Messrs. Lancaster, Birk and Robinson. City Clerk O'Bryan will carry the case to the court of appeals. The case of Messrs. Lancaster, Birk and Robinson will come up for hearing at the June term of circuit court.

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Oakland Water Rate Ordinance Invalid.

A decision was rendered May 18, by Judge E. C. Hart of Sacramento in the case of the Contra Costa Water company against the city of Oakland. The court was asked to declare invalid the ordinance passed by the city council fixing the water rates for last year. Judge Hart holds that the ordinance is invalid; that the value of the company's property for rate-paying purposes is $7,000,000; that the Alvardo plant recently purchased by the Contra Costa company is necessary for the water supply of Oakland. Judge Hart says that the rates fixed by the ordinances would only yield the company 2 per cent. on its investment.

Cedar Rapids, Ia., Water Rate Ordinance Invalid Because Unreasonable.

Judge W. N. Treichler has handed down an opinion in the case of the Cedar Rapids Water company vs. the city of Cedar Rapids, Ia., et al. The company asked the court to permanently enjoin the city from enforcing the provisions of the new water rate ordinance, claiming that the rates were insufficient to give it fair returns on the investment; that if enforced the rates fixed by the ordinance will reduce its earnings and income from private consumers more than 30 per cent., and that it can earn no adequate or fair compensation or dividend upon the cost of its water works system. Judge Treichler held that the rates fixed by the ordinance are unreasonable and cannot be sustained. The case will be appealed to the supreme court.

Detroit Water Commissioners Not Required to Furnish Free Water to City.

The Michigan supreme court rendered a decision recently in the application for a mandamus by the Detroit water board to compel the park commission to audit claims for payment of water furnished. The park board refused on the ground that the water commission had no right to charge the city for water and that there was no appropriation on hand to pay the claim. The supreme court held that the water board does not have to furnish free water to the city.

Assessment for Cost of Water Main Sustained—A Case Without Precedents.

Judge Tallman of the superior court rendered a decision May 2 in the suit instituted by R. C. Smith to enjoin the city of Seattle, Wash., from assessing his property for the cost of laying a six-inch water main along the street abutting on his property. The plaintiff claimed that the city had no right to charge the cost of the mains to property-owners and then charge them for the water which flows through the mains. In reply the city claimed that this case, on analysis, is no different from that of the man who is assessed for the laying of the street abutting his property and is then assessed with a license for the privilege of drawing a vehicle over it. The fact that neither side was able to cite any authority in support of their respective contentions was regarded as an unique feature in legal practice. Judge Tallman sustained the demurrer of the city and declared in effect that the assessment of the cost to the abutting property-owners was thoroughly within the city's province.

Rule Requiring Year's Contract for Water Declared Unreasonable.

Judge Rolapp rendered a decision recently in the case of Charles Gosling vs. Bear River Irrigation and Ogden Water Works company, wherein the plaintiff brought suit to obtain a writ compelling the defendant company to turn back the water after it had been shut off by the defendant upon the plaintiff's refusal to sign a contract for one year. The plaintiff paid the company for water for his premises from Sept. 1, 1896, to Jan. 1, 1897, and asked that the water be turned on, but the company refused to comply with the request, claiming that the amount per annum should be paid. The court would not grant the writ, but rendered a rule regarding the company's rules of requiring the signing of contracts, as follows:

Rule 2 provides that "water is furnished by this company for a term not less than one year. All bills are payable semi-annually in advance, due the first of January and the first day of July."

There is no doubt that the water company may make and enforce rules for the government of their customers, but such rules must be reasonable, and when they are such, all persons dealing with the company as well as the company itself, must yield obedience thereto. But the duty of the company towards its customers, and that of the latter to the former, is somewhat reciprocal, and any rule or regulation or course of dealing between the parties which does not secure the just rights of both ought not to be accepted, and cannot be sustained by the courts. I can hardly say that the rule that the company will not sell water for any premises for a less time than one year is a reasonable rule. Under the rules of this company, any tenant can apply for water connection; and it would seem that, even if the tenant proposed a temporary residence upon the premises, that he would be compelled to contract for the use of water for the entire year, and pay for six months in advance. I recognize that the rules provide that in case of vacancy the contract shall be annulled, but I apprehend that many instances can arise in which this provision would not obviate the injustice otherwise created by the contract. My attention

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has not been called to any case in which such a rule has been sustained as reasonable, while I admit that the facts in one adjudicated case (162 Mass. 556) show that another company has a similar rule, but in that case the reasonableness of that rule was not tested; but in the case of Rockland Water company vs. Adams (24 Atl. Rep. 840), it is expressly held that a regulation of a water company, providing that takers of water shall be liable to pay rent for the whole year whether they actually used it for that length of time or not, and to make payment yearly in advance, without special agreement, is unreasonable.

With that doctrine I concur. But, on the other hand, there must, of course, be some period established during which consumers shall agree to take water, if they take it at all. It would be unreasonable to require the company to contract for and collect its water rates daily, weekly or monthly. I am of the opinion that requiring six months use as a condition precedent for furnishing water is not unreasonable. It would not be necessary for the purpose in this case, to pass upon the question as to whether different rules must be agreed upon by express contract of the parties. The payment in advance for such reasonable period of time, I think is also a reasonable regulation, which the company may enforce by shutting off the water.

I therefore think that rule 23 is reasonable, except in so far as it requires the additional payment of $2 for shutting off and turning on the water. I think this latter rule is unreasonable, discriminatory and void, since, necessarily, compensation for turning off and the water is included in the water rents.

Vitrified Pipe for Water Conduits.

In connection with the paper on vitrified pipe conduit at Hartford, Conn., in our March number, the report from Little Falls, N. Y., will be of interest. City Engineer John McComb says that about 4,200 feet of the vitrified pipe conduit supplying that city has been replaced during the past year with cast iron pipe. Other parts are in bad condition and must soon be replaced. The pipe operated for some days under a head which seems to have been sufficient to injure it seriously.

Effect of Water Meters at Oberlin, O.

The reduction of water waste by meters at Oberlin, Ohio, is shown in the report of Secretary A. G. Comings of the Water Works Board, as follows;

Year	1893	1896	1899	1900
Taps	328	471	596	625
Meters ...	71	174	305	392
Revenue	$2,604	$3,964	$5,146	$5,345
P'ge, gls.	31,000,000	24,584,000	38,759,000	36,560,000

New Jersey Jury Awards Damages for Stream Pollution.

A jury in the Bergen circuit of the Supreme court of New Jersey has awarded damages against the city of Paterson for polluting the Passaic river. The plaintiff, who manufactured ice, claimed that his ice business had been ruined by the sewage of the city, and that some 3,000 tons of ice in storage had become unsalable, presumably on account of the agitation regarding the pollution of the stream. He was awarded $3,000 damages for the ice, but none for injury to his business as a whole. The city will appeal.

Location of New Mississippi River Dam at Minneapolis Sustained.

The Minnesota supreme court rendered a decision March 29 in the suit of W. W. Eastman vs. Minneapolis water power companies, in which every point of the judgment of Judge Simpson of the district court is sustained. The case grows out of the claim of Dr. A. H. Hedderly that the new dam across the Mississippi river was so constructed that its operation would infringe the legal rights of the owners of a tract of land situated upon the west side of the river, below the dam. Dr. Hedderly was backed in his suit by W. W. Eastman and other interests represented by the Minnesota Loan and Trust company, and these parties brought suit asking for an injunction against the St. Anthony Falls Water Power company and the Minneapolis Mill company, and a decree that the dam and improvements be removed from the river. Judge Simpson's decision, which was filed in January, 1900, found all the facts against the claim of the plaintiffs and sustained the claim made by the defendant water power company as follows:

(1) That no injury was or would be done to the rights of the plaintiffs by the operation of the new dam. (2) that the defendants were making only a reasonable use of their rights in the river as against the rights of the plaintiffs; and (3) that the land of the plaintiffs was so situated that the water power rights which the plaintiffs claimed to have in the river were of no value, because no development of that power was feasible.

The supreme court expressly upheld these findings of Judge Simpson.

Argument for Narrow Paved Roadways.

In his annual report for 1900, Andrew Rosewater, city engineer of Omaha, discusses narrow paved roadways in city streets. He says:

A characteristic feature of paving work in the last year has been the tendency to minimize the paved width between curbs resulting in not alone economizing in the

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cost of paving, but in the improved appearance of narrow residence streets. Eight years ago I advised the reduction of space between curbs from forty to thirty feet on residence streets and submitted ordinances providing for such reductions on all such streets where pavement or repavement was contemplated, thus reducing the mileage cost of paving 25 per cent Public sentiment has gradually developed a tendency to still narrower pavements, and, in my judgment, a large portion of future residence streets will be reduced to twenty-two feet between curbs. This will so reduce the cost that nearly every section of the city will have within reach a paved roadway from the central portion of the city. The questions most frequently asked are, can a wagon turn on so narrow a space, and can more than two teams comfortably pass each other? The answer is that it is but little trouble to drive to an intersection for the purpose of turning; besides, the necessity for turning is not of sufficiently frequent nature to justify a large extra outlay for that purpose. As to the facilities for more than two teams to pass at a time, the traffic on residence streets seldom calls for more than two teams to pass comfortably, and as in the case of turning, the infrequency of such occurrences does not justify a 50 per cent. increase of permanent outlay for the occasional luxury.

Action of Philadelphia Officials in Recent Asphalt Competition Sustained.

A decision was rendered May 3 by Judge Wilson of Court No. 4, Philadelphia, in the equity suit brought by W. S. P. Shields, Charles B. Prettyman and others, as citizens and property owners, and the Warner-Quinlan Asphalt company, against the city, the mayor, Director Haddock and the four paving companies said to form part of the "asphalt trust." The plaintiffs claimed that the work should have been awarded to the Warner-Quinlan company, as the lowest responsible bidders. A question was also raised as to the legality of councils inserting the word "lake" in the ordinance of March 27, 1901, as designating the kind of asphalt to be used. Director Haddock asserted that the Warner-Quinlan company had not complied with the requirements of the specifications by filing certain samples at the bureau of highways, and he declined to schedule or consider the company's bids. The samples were entered by an agent of W. S. P. Shields, a partner in the Warner-Quinlan company. The plaintiffs assert that this was done on behalf of the company. On the other hand two attaches of the bureau of highways testified that they were filed on behalf of Mr. Shields individually. The court in its opinion deals with this single question. Judge Wilson, after reviewing the testimony, says:

There appears to be good reason for believing that Mr. Shields and the Warner-Quinlan company had entered into some sort of a business arrangement, with the intention of entering into competition for paving contracts. We think, however, that it is equally clear that these arrangements had not reached such a point on April 6, the day when the samples are claimed to have been deposited on behalf of that company, that the firm was prepared to present its bids or take definite steps in that direction.

It is unquestionably true, unless one is to disregard all ordinary rules of interpreting human conduct, that it was then intended that the bids should go in to the office of the Highway Department in the name of Mr. Shields, while it is doubtless also evident now, in view of the light subsequently thrown upon the transaction, that he expected to give to the Warner-Quinlan company, in connection with himself, the benefit of any contract which might be awarded to him. There is nothing before us which would warrant the inference that even so much as that was known to the authorities of the city.

Under the circumstances just mentioned, the samples were deposited by an agent of Mr. Shields. It is hardly credible that, if it had been understood or intended that the depositing of these specimens should accompany a bid of the Warner-Quinlan company, the receipt would have been made out or taken in the name of Mr. Shields. In point of fact, it was not until the Monday following that the plans were changed and the intention arrived at to put in bids in the name of the company.

In conclusion, Judge Wilson says that there is nothing in the evidence to warrant a conclusion that the conduct of the public officers concerned was fraudulent, or based upon improper motives.

Special Assessments for Street Improvements in Washington Sustained.

The United States Supreme Court rendered a decision April 29, in the case of the commissioners of the District of Columbia vs. Charles D. Davidson, in which the question of benefits and damages to property by reason of the opening of streets was involved. The decision makes it legal for municipalities to make special assessments for street improvements.

Two Federal Court Decisions on Frontage Assessments.

The United States supreme court rendered a decision recently in the suit of the town of Tonawanda, N. Y., against James B. Lyon. The town of Tonawanda eight years ago assessed property-owners $250,000 to pay for the pavement of Delaware ave. Capt. J. T. Jones brought suit in the supreme court to have the assessment set aside. The supreme court decided against the town and was sustained by the appellate division. The court of appeals, however, reversed the judgment of the lower court and decided in favor of the town.

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holding that the assessment should stand. When argued before the supreme court again the action brought by Capt. Jones was dismissed. James B. Lyon of Albany, another property-owner, then brought action in the United States circuit court, claiming that the assessment was invalid and in violation of the constitution of the United States relative to property not being taken without due process of law. Also that the assessment was not distributed according to the benefits received. Judge Coxe of the United States circuit court decided in favor of the plaintiff and set aside the assessment. The town appealed, with the result that the United States supreme court reversed the decision of the circuit court and held that the assessment is valid and must be paid. In rendering the decision the court explained the decision rendered in the Norwood-Baker case in Ohio which led all the courts of the country to suppose that all foot-front assessments are invalid. The court states that foot-front assessments are not invariably invalid, as that decision led many to suppose, but that the plaintiff must show that the assessment was not laid according to benefits received.

The United States supreme court handed down an opinion April 29 sustaining the Missouri supreme court in its decision in the case of French vs. Barber Asphalt paving company. The Missouri supreme court held that the mode of assessing for paving according to "the front foot rule was not in violation of the federal constitution, and was therefore not void and that the costs for paving could be assessed against the abutting property. In affirming the decision of the Missouri supreme court the United States supreme court says:

The array of authority was confronted in the courts below with the decision of this court in the case of Norwood vs. Baker (172 U. S. 269), which was claimed to overrule our previous cases and to establish the principle that the cost of a local improvement cannot be assessed against abutting property according to frontage, unless the law, under which the improvement is made, provides for a preliminary hearing as to the benefits to be derived by the property to be assessed.

But we agree with the supreme court of Missouri in its view that such is not the necessary legal import of the decision in Norwood vs. Baker. That was a case where, by a village ordinance, apparently aimed at a single person, a portion of whose property was condemned for a street, the entire cost of opening the street, including not only the full amount paid for the strip condemned, but the costs and expenses of the condemnation proceedings, was thrown upon the abutting property of the person whose land was condemned. This appeared, both to the court below and to a majority of the judges of this court, to be an abuse of the law and an act of confiscation, and not a valid exercise of the taxing power. This court, however, did not affirm the decree of the trial court awarding a perpetual injunction against the making and collection of any special assessments upon Mrs. Baker's property, but said:

"It should be observed that the decree did not relieve the abutting property from liability for such amount as could be properly assessed against it. Its legal effect, as we now adjudge, was only to prevent the enforcement of the particular assessment in question. It left the village, in its discretion, to take such steps as were within its power to take, either under existing statutes or under any authority that might thereafter be conferred upon it, to make a new assessment upon the plaintiff's abutting property for so much of the expense of the opening of the street, as was found upon due and proper inquiry to be equal to the special benefits accruing to the property. By the decree rendered the court avoided the performance of functions appertaining to an assessing tribunal or body, and left the subject under the control of the local authorities designated by the states."

That this decision did not go to the extent claimed by the plaintiff in error in this case is evident, because in the opinion of the majority it is expressly said that the decision was not inconsistent with our decisions in Parsons vs. District of Columbia (170 U. S. 45-56), and in Spencer vs. Merchant (122 U. S. 345-357). It may be conceded that courts of equity are always open to afford a remedy where there is an attempt, under the guise of legal proceedings, to deprive a person of his life, liberty or property without due process of law. And such, in the opinion of the majority of the judges of this court, was the nature and effect of the proceedings in the case of Norwood vs. Baker.

But there is no such a state of facts in the present case. Those facts are thus stated by the court of Missouri:

"The work done consisted of paving with asphaltum the roadway of Forest-ave. in Kansas City, thrity-six feet in width from Independence-ave to Twelfth-st., a distance of one-half a mile. Forest-ave. is one of the oldest and best improved residence streets in the city, and all of the lots abutting thereon front the street and extend back therefrom uniformly to the depth of an ordinary city lot to an alley. The lots are all improved and used for residence purposes, and all of the lots are substantially on the grade of the street as improved, and are similarly situated with respect to the asphalt pavement. The structure of the pavement along its entire extent is uniform in distance and quality. There is no showing that there is any difference in the value of any of the lots abutting on the improvement."

What was complained of was an orderly procedure under a scheme of local improvements prescribed by the legislature and approved by the courts of the state as consistent with constitutional principles.

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Winnipeg's Municipal Asphalt Plant.

The city of Winnipeg, Man., has operated a municipal asphalt plant for about two years on which a report is now available. There are two melting tanks, a sand drum, sand elevators, hot and cold, limestone grinding mill, limestone, hot asphalt and hot sand storage tank and bins, a mixer with a capacity of 7 cubic feet, 30 horse power engine, 60 horse power boiler, air compressor, etc. The plant requires a force of about twelve men, superintendent, engineer, two firemen, two asphalt melters, one dipper and mixer, one man for sand and lime, one recorder, a general utility man, and about two shovelers for sand and limestone. About 1,000 square yards of 2-inch top can be laid in nine hours at a cost of $40.

On 4½-inch Portland cement foundation, with 1½-inch binder and 2-inch wearing surface, the asphalt pavements have cost $2.064 a square yard in 1900. In 1899 the cost was $2. These are the actual expenditures, with the exception of some which were charged to the cost of the plant, being of permanent character.

North American Asphalt Deposits.

The following description of the deposits of asphalt in the United States and Mexico is taken from an address on the Asphalt Paving Industry by P. W. Henry before the students of Rensselaer Polytechnic Institute, Troy, N. Y.:

Alcatraz is a trade name rather than a specific kind of asphalt. This material comes from California, and its occurrence is very different from the Trinidad and Bermudez asphalts. In fact, there are no asphalt lakes in the United States, but the material occurs either in veins, similar to coal and other materials, or it is mixed with sand and the asphalt must first be extracted. Asphalt of certain grades is also produced by driving off the lighter oils from the crude oil found in California and elsewhere.

The Alcatraz asphalt as originally placed on the market was a mixture of hard asphalt taken from veins located at LaPatera and of liquid asphalt obtained from Carpenteria, some 15 miles distant. The hard asphalt contained from 55 to 60 per cent. of bitumen, about the same as Trinidad, but was considerably harder. The liquid asphalt was extracted from asphaltic sand by boiling the latter in large vats of hot water. The liquid asphalt would rise to the top, was skimmed off and shipped by railroad to LaPatera. The proportion of liquid asphalt would vary according to the consistency of the asphalt cement desired. Generally it was necessary to add residuum at the paving plant. Finding this method of producing asphalt too expensive, it was decided to extract the asphalt or bitumen from a large deposit of asphaltic sandstone located in Santa Barbara county. This sandstone contains from 12 to 18 per cent. of bitumen which is extracted by dissolving it in naptha, then piping this solvent to Alcatraz landing on the coast, 30 miles distant, evaporating the solvent, pumping the solvent back to Sisquoc, where it would be used over again, and running the asphalt or bitumen into barrels ready for shipment. This scheme necessitates two plants, one at Sisquoc and one at Alcatraz Landing, both of them elaborate and the most costly of any asphalt plants in existence.

At Sisquoc, the asphaltic sandstone is quarried by blasting down the open face. An electric crane operated by a dynamo in the main building, loads the rock into a car which is hauled by cable to the hopper over the crushing rolls. These rolls are fluted and the final pair only three inches apart. The crushed rock is then conveyed to the melter, a large steam-heated drum, where it becomes plastic and mushy, somewhat like the hot asphalt paving mixture as it is laid on the street. This mushy material then goes to another drum where it is mixed with the solvent, naptha, containing considerable asphalt which has beeen dissolved from a previous charge. The material then goes to a settling tank where the saturated solution of asphalt and naptha is drawn off and delivered to a tank at the head of the pipe line, whence it goes by gravity to Alcatraz Landing. The sediment in the settling tank, which still contains some asphalt, is forced by a screw conveyor into another tank where it is further mixed with solvent, until after several operations of this sort the asphalt is entirely dissolved and the sand left clean and white. As the sand, however, is wet with the solvent, the latter must be recovered, and this is accomplished by heating the sand in steam-jacketed drums. The solvent goes into the condensers and is then used over again. The clean, dry sand is then conveyed to the dump. At Alcatraz Landing the solution is placed in stills, the naptha driven off and recovered in condensers, whence it is pumped back to Sisquoc and used over again. The asphalt is run into barrels and is then ready for shipment, either by rail or water. For water shipment there is a pier about 800 feet in length along which vessels can lie.

There are many other deposits of asphalt in California, but with a few exceptions they have not been largely developed. In most cases the asphalt occurs in veins or pockets and must be mined and then fluxed with liquid asphalt to obtain the proper consistency.

In Indian territory, Texas and Kentucky are deposits of rock asphalt which have been used successfully in laying pavements, after the manner of the European rock asphalts. These materials, however, cannot be used very far from the point of their occurence, owing to the cost of freight. The deposits in Indian territory have been used chiefly in Kansas City and St. Louis, those of Texas in Houston and San Antonio, those of Kentucky in Louisville. In Indian territory there are deposits both of asphaltic limestone and sandstone, and in order to make a good pavement these asphalts must be mixed in the proper proportions. In order to use the Kentucky asphaltic sandstones successfully, it is necessary to mix with them various European asphaltic limestones or other asphalts. Several attempts have been made to extract by hot water or naptha the asphalt or bitumen from these as-

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phaltic sandstones, but commercially they have been failures.

In Mexico, along the coast not far from Tampico, have been found springs of asphalt, which in quality resemble Bermudez asphalt, although somewhat softer. These springs, however, give out a limited quantity of asphalt and only occasional cargoes find their way to this country.

Track Depression in Milwaukee.

Estimates for track depression in the Eighteenth ward, Milwaukee, Wis., have been prepared by Charles J. Poetsch, city engineer. He states that the cost of depressing the Northwestern tracks twenty-one feet below the established grade of the streets will be $236,000, which exceeds by $100,000 any previous estimate of the cost of the work. The profile drawings show that the depression will begin at a point 1,400 feet south of Lafayette-place at an elevation of thirty-seven feet above the city datum line, and with a descending grade of 0.53 per cent., runs a distance of 1,300 feet to a point near Lafayette-place, at an elevation of thirty feet above datum line; with an ascending grade of .017 per cent.; it then runs to a point 1,850 feet distant to the center of North-ave., thence to Folsom-place, at an elevation of forty-five feet above datum. From this point to the city limits it runs with an ascending grade of .342 per cent. The entire length of railway affected will be two miles.

Washington, Pa., Must Purify Its Sewage.

In accordance with a decision rendered May 2 by Judge McIlvane the borough of Washington, Pa., will have to provide some other plan for disposing of the sewage at the outlet below the fair grounds than by letting it empty into the creek at that point. The decision was rendered in the equity proceedings brought by the Tyler Tube Mill and others. The conclusion of the court is as follows:

1. That the construction of the defendant's sewer and the appropriation of that part of the creek bed that is located on the Clark farm as the place where its output would be emptied into Chartiers creek was not, per se, the creation of a nuisance.

2. That when the flow of water in the stream is not sufficient to carry away such output in a manner so as not to substantionally injure the land owners below, but on account of lack of water or for other reasons deposits are made that pollute the water and create noisome and disagreeable smells that may be injurious to health, then and then only can the maintenance of a nuisance be charged against the borough.

3. That the operation of the defendant's sewer since its construction has shown that there is not sufficient water in Chartiers creek the year round to carry away the sewage matter and dispose of it, as the act of assembly authorizing its construction requires it to be disposed of, and that, although the nuisance complained of may not exist throughout the whole year, yet that the recurrence of this nuisance is so frequent and at such stated intervals as to make it in a legal sense a continuing annoyance to the plaintiffs and not an extraordinary and occasional occurrence.

4. That equity has jurisdiction to remedy the wrong complained of.

Arguments in St. Louis vs. Chicago Drainage Canal.

The Chicago drainage canal case was up before the United States supreme court May 13, when the state of Missouri filed an amended bill, alleging actual damages, and the state of Illinois and the sanitary district jointly answered the complaint. At a conference of the attorneys in the case to consider plans for securing and presenting evidence, it was agreed that the court should be asked to appoint a commissioner to take testimony and that this commissioner should begin on Sept. 9 and take testimony until the counsel for Missouri is satisfied. The commissioner should then begin taking testimony under the direction of the defendants to the suit. The counsel for Missouri in the amended bill alleged actual damages caused by opening the drainage canal and the flow of Chicago sewage into the Illinois and Mississippi rivers. The bill also alleges that by reducing the flow of water to 200,000 cubic feet of water per minute, the sanitary district is not complying with the Illinois law creating it. The counsel for Illinois and the drainage district demur to this part of the bill because the amount of water does not affect the complaint of discharging sewage into the river and because it is a question to be settled between the state of Illinois and the drainage district as the latter would have to answer to the state for its compliance with the state law. The defendants enter a general denial to the general complaint of contaminating the water supply of St. Louis and other Missouri towns, and allege that the sewage from St. Louis and its suburban towns, discharged into the Mississippi river at that point, causes a much greater pollution of the water of the river from which the cities in both Missouri and Illinois, south of St. Louis, take their water supply. Also that the flow of the Missouri river into the Mississippi at the same point presses the waters from the Illinois river against the Illinois shore, so that they do not mix with the waters on the west shore, where St. Louis has her intake for water supply. It is further alleged that the waters of the Mississippi river are about six times the volume of the waters in the Illinois river, even at low water stage, and that this greater volume would press the

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waters from the Illinois against the Illinois shore.

Wooden Forms for Concrete Work.

Methods of constructing forms for concrete work were described in a paper by Mr. C. R. Neher, read before the Engineers' Society of Western New York on March 5. He says:

To produce smooth work the addition of granolithic face or plastered surface is unnecessary, smooth forms, with concrete well proportioned will give just as smooth work at much less cost, leaving the whole mass uniform, without a line of separation, or different compressive strength. Another way to produce finish is to joint the concrete to represent masonry, using rough lumber for forms, then bush hammering the face, which can be done by an ordinary laborer at 1½ cents per sq. ft., the amount saved by using rough lumber going a long ways towards paying for the bush hammering. This removes all impressions from inequality of moulds, efflorescence, etc.

The preparation of forms calls for considerable ingenuity, and every contract requires special study, to the end that smooth surfaces be left, with unbroken corners, that the swelling of the wood does not rupture the concrete or leave distorted surfaces, and that the forms be so designed as to be used several times, and readily set up and taken down, and later on converted to other uses. As the charge for forms against the concrete can seldom be kept below 50 cents per cu. yd., for heavy work there is always an opportunity for careful plans, and all depends on the ingenuity of the designer, as few rules can be laid down for his guidance. The use of matched, or tongue and grooved stuff is not desirable, as concrete fills in the openings and there is no opportunity to expand from moisture, unmatched boards dry apart and let the water in the concrete leak out, carrying with it some of the cement, later on they swell and buckle, and if used as interior forms burst the concrete, the best way devised so far is to bevel one edge of the boards, using narrow stuff, not to exceed 6 inches, the sharp edge of the bevel lying against the square edge of the adjoining board allows the edge to crush when swelling, closing up the joint, and preventing buckling.

A coat of soft soap before filling the forms prevents the concrete from adhering to the forms, which should always be scraped and brushed with a steel wire brush when taken down.

Square corners should be avoided as they readily slip off, and where used as interior forms for recesses or cellular construction, a fillet should always be placed in the corners.

Objection to Foreign Corporations Act of Indiana.

A communication was received recently by Secretary of State Hunt at Indianapolis, from William B. Hord, an attorney of New York City, remonstrating against the foreign corporation act requiring outside companies to pay fees on the amount of business they have in Indiana. The letter showed companies incorporated under the laws of Maine, although all their business is thought to be in Indiana, as follows: Shelbyville Water & Light company, capital stock, $225,000; Warsaw Water company, $90,000; Crawfordsville Water & Light company, $300,000. The companies were incorporated in 1895. The attorney for the three companies objects to the payment of the fee which the new law requires, on the ground that it violates the obligation of contracts. If paid the total fee on all three companies will be $616.30. Secretary Hunt says the fee will have to be paid.

Public Play Grounds in London.

The London school board has adopted the plan of opening the play grounds on Saturday afternoons, and there are now 253 such places of recreation available for children, mostly in poor neighborhoods, where there is no public park within easy access. About 3s extra is paid to the school keeper for every Saturday on which the ground is kept open, thus making the cost very little. The doubt that existed when the experiment was undertaken regarding its success was quickly dispelled by the lively interest that the children displayed in taking advantage of the Saturday afternoon's play. The board intends, therefore, to persevere in the useful work. Many of the grounds are fitted with gymnastic appartus, thus giving the children the benefit of some little muscular exercise, as well as a good day's romp.

City Property Subject to Execution in Ohio.

Judge Frazier, of the common pleas court, Zanesville, O., assessed a fine of $200 and costs on Dr. J. L. Holden, mayor of Zanesville, May 23, for contempt of court. The mayor recaptured the city patrol wagon by force after the sheriff had seized it on an execution. The chief of police and five patrolmen performed the act under the mayor's orders, and were assessed costs in their respective cases.

Chicago Statistics.

The city of Chicago has established a Municipal Library and Bureau of Statistics to make a collection of books and papers relating to city affairs and collate and publish statistics regarding the city. The first number of the bi-monthly issue

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of the statistical tables is at hand and gives municipal statistics for January and February in the various departments—civil service, streets and alleys cleaned, garbage removed, water supply, buildings, lighting, sewers, fires, house of correction, police, mortality, contagious diseases, laboratory and sanitary inspection, free baths, public schools, compulsory education, libraries, grain, flour and provisions, live stock, vessels, imports, clearing-house. Blanks are left for the remaining months of the year, it being the evident intention to reprint in each issue the statistics of each month in the year to date. There is also a large comparative table of statistics for each year since 1893.

Rotary Cement Kilns in England.

A paper before the Institution of Civil Engineers by W. H. Stanger and B. Blount describes the rotatory process of manufacturing cement, which presents the advantages that the operation is conducted continuously and mechanically instead of intermittently and by the aid of much hand labor, and that the product is better and more uniform than that obtained by the old method. By this process it is possible to obtain a cement which is stronger and sounder than the best cements commercially prepared by discontinuous processes. The output per unit of plant is more than double that of the best fixed kilns, and the consumption of fuel is smaller; a cheaper class of fuel, viz., small coal instead of coke, can be used. Various forms of fixed kilns were described and discussed, and their merits and defects were pointed out. The history of the evolution of the rotatory kiln was traced.

The percentage of coal needed to burn raw materials to cement clinker was computed under various stated conditions. The calculated minimum quantity amounts to 8.23 per cent. on the weight of the clinker when dry raw materials are used, and the waste gases escape at 300 degrees C. (572 degrees Fahr.). When the raw materials are in the form of slurry containing 40 per cent. of water, the calculated minimum quantity is 19.40 per cent., with the waste gases at 300 degrees C. ((572 degrees Fahr.) and 17.01 per cent. with the waste gases at 200 degrees C. (392 degrees Fahr.). Tables were given showing the allocation of the heat to the performance of the chemical reactions necessary to produce clinker, to the heat lost in the clinker and in the waste gases, and to the drying of the slurry when wet raw materials were being dealt with. This last-named item is large, being nearly 50 per cent. of the total quantity of heat requisite.

The successful development of the rotatory process in America has been aided in great measure by the cheapness of petroleum in that country. The difficulty of obtaining and maintaining a high and uniform temperature disappeared when oil was substituted for producer gas. The lining trouble has remained except in one case, where it has been completely overcome. The largest and most complete installation of rotatory kilns was that at the works of the Atlas Cement company of Northampton, Pa., which had been examined by the authors in 1898. The output of this works was between 8,000 and 9,000 tons per week, i. e., about four times the amount of most large European works, and the whole quantity was obtained from rotatory kilns. There are at present fifty-one kilns in operation, and forty-eight are about to be added, nearly doubling the output given above. The whole of this plant is on the rotatory system invented by Messrs. Hurry & Seaman. The raw materials used by the Atlas company are a calcareous shale and a limestone. These are crushed, dried, finely powdered and fed mechanically into rotatory kilns. The kilns are steel cylinders 60 feet by 6 feet 6 inches, set on a slight incline and capable of being rotated by suitable gearing.

The fuel is powdered coal driven in by a blast of air through an injector burner at the lower end of the kiln. An intensely hot flame, readily controllable, is thus produced, and heats the raw material introduced at the upper end of the kiln and causes it to travel downward in a direction opposite to that of the blast. The materials are thus heated systematically and at the lower end of the kiln near the burner become converted into clinker. This falls into a rotating cylinder lined with firebrick, through which passes a current of air serving to feed the coal-dust flame. A great part of the heat of the clinker is thus regenerated. The clinker is then roughly crushed between rolls which work under a spray of water and passes through a final rotating cooler into trucks, by which it is conveyed to stock-boxes over the grinding-plant. Huntingdon mills are used for the whole of the grinding-plant, whether for raw materials, powdered coal or clinker. From the crushing of the raw materials to the storing of the finished cement, no hand labor is employed, all conveyance, distribution and transmission being done mechanically. The firebrick lining of the kilns is protected by a layer of clinker which is perfectly effective.

The crushing, watering and cooling of the clinker has the effect of maturing the cement, and storage and aeration usually necessary for cement made by the old process are abolished. Tests and analyses of the cement show it to be of high quality and perfectly sound. The cost of manufacture does not exceed 12s 6d per ton, as against an average of 20s for cement made on the old system. The process could

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be applied with success to wet raw materials, and a large plant for treating these is now being erected in this country. When wet raw materials are used they are pumped in the form of slurry into the upper part of the kiln which is then unlined, and are dried by the waste heat of the furnace gases. In other respects the process is identical with that using dry raw materials. A table of comparative costs of the old and new systems was given, which justified the conclusion that the complete replacement of fixed kilns by a well-devised rotary system would take place in Europe as it was already occurring in the United States.

Production of Anthracite Coal.

The United States Geological survey has issued a combined map, diagram and table showing the three Pennsylvania anthracite coal regions and the tonnage mined from each district in each year since 1820. The increase in the total output has averaged more than 750,000 tons per annum since 1850, the total quantity mined in that year being 3,358,899 tons and in 1900, 45,107,484 tons. The latter figure has been exceeded twice, in 1894 and in 1899. The production in the Wyoming region has increased much more rapidly than in the Lehigh and Schuylkill regions. That region furnished but 25 per cent. of the total in 1850 and now furnishes about 55 per cent.

Purity of Election Law Has Little Standing in California Supreme Court.

The California Supreme Court handed down a decision May 11 in the contest between William Land and George H. Clark over the office of Mayor of Sacramento. The court recognized the contentions of Clark. William Land, the former mayor, refused to give up the office when Clark was elected, contending that the latter's expenditures were in excess of the sum specified in the election law. After very careful consideration of the matter the court takes the position that Land's claim is unwarranted, for it was found that Clark's expenditures were so small as not to constitute a violation of the law. Justice Garouth, who wrote the decision, says that for the court to annul the election of a mayor of Sacramento by reason of a defect of a single item of the character at issue would be to give the law a construction that might well be termed "sticking in the bark." Successful candidates are not to forfeit their offices merely for technical violations of the purity of election acts.

Public Employment Bureau for Syracuse N. Y.

The establishment of a county bureau of employment is being considered by the board of supervisors at Syracuse, N. Y. The plan regarded most favorably involves both a county and city bureau, both to be under the direction of the superintendent of the poor. Farmers anad employes generally could apply to the bureau for information as to men who wanted to work, and unemployed men could file applications for work with the bureau. The plan is to have little or no expense attached to the operation of the scheme, although a small fee from employers who secure help has been suggested. That is not essential, however, to the establishment of the bureau.

New Publications.

A Manual of Field and Office Methods for the Use of Students in Surveying. By William D. Pence, Professor of Civil Engineering, Purdue University, Lafayette, Ind., and Milo S. Ketchum, Assistant Professor of Civil Engineering, University of Illinois, Champaign, Ill., 232 pp; cloth, with flap, pocket size, $2. For sale by the authors.

This manual was published primarily for the authors' classes in surveying, and was in successful use in leaflet form for a year before its recent publication. It is a working manual for the student and an invaluable aid to the instructor in assigning work, being a great saver of instructor's time. The work is arranged in the form of progressive problems with full notes and instructions for every step of each process, including all details, even to signals between members of the party and method of driving stakes. The statement of the problem or exercise which the student is to work out is given on the left hand page and the form of note book entries is given on the opposite page. Full descriptions of the instruments and their adjustments appear in their proper places for the progress of the student, and full descriptions of the duties of each member of a surveying party find a prominent place. The chapters take up the chain and tape, the compass, the level, the transit, topographic surveying, land surveying, railroad surveying, errors of surveying, methods of computing and free hand lettering. Thus the field of the ordinary surveyor and field engineer is well covered, and an excellent basis is laid for the development of special methods required for other classes of work. Very properly the most refined methods and instruments are omitted, their consideration belonging to special books or special courses, since the number of men requiring such knowledge is comparatively small. It is proposed to add tables of logarithms, etc., in a second edition. It is not improbable that a second book with a set of tables, such as can be easily obtained, will be quite as satisfactory. The book will probably have a large sale for class use, and should be particularly suited to the use of the private

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student on account of the unusual detail of description of methods.

A Treatise on Highway Construction, designed as a text book and work of reference for all who may be engaged in the location, construction or maintenance of roads, streets and pavement. By Austin T. Byrne, C. E. Fourth revised and enlarged edition. 306 illustrations, 906 pp.; cloth, $5.00. New York, John Wiley & Sons.

The value of this book has already been acknowledged in these columns and further notice of it will doubtless appear from time to time. The new edition has lost some obsolete matter, and gained about 125 pages in expansion of the treatment of stone, brick, broken stone, asphalt and coal tar pavements, and in tables on asphalt production and manufacture and the comparative cost of laying and maintaining pavements in various cities, and a number of forms for specifications.

American Society of Municipal Improvements.

The eighth annual convention of the American Society of Municipal Improvements will be held in the city of Niagara Falls, N. Y., Oct. 1st to 4th, inclusive. A most attractive program is in course of preparation on all subjects pertaining to municipal work, which will be of interest to all city officials. In addition the members will be given an opportunity of inspecting some of the numerous plants attached to that locality by the enormous electric power now produced by the falls. The Pan-American exposition will furnish much instruction and entertainment for every good American and will be visited by all who have the opportunity. Buffalo, in which city the exposition is being held, is one hour's ride from the falls.

National Municipal League Convention

The seventh annual meeting of the National Municipal League was held in Rochester, N. Y., May 8, 9 and 10. In reviewing the work of the American Society of Municipal Improvements, N. P. Lewis, of of Brooklyn, said he thought the various associations devoted to municipal affairs could do better work as separate bodies than if consolidated, as had been suggested of late. A resolution was adopted requesting the executive committee of the league to invite the American Society of Municipal Improvements, the League of American Municipalities and kindred organizations to hold a conference some time next year. Dr. Thomas M. Drown, of Lehigh University, chairman of the committee on Instruction in Municipal Government in American Educational Institutions, presented a report, in which he said that letters sent to 357 colleges and universities had resulted in 222 replies, of which about forty had stated that the institutions concerned had courses of instruction in municipal government. The committee is working on a bibliography for the guide of those who are teaching municipal government, and it is also preparing suggestions for a course of study. The need of endowments for special chairs of municipal government, and also the need of more research work, was suggested by a subsequent speaker.

In a paper on the subject of the Chicago street railway situation William Ritchie showed that the problem of street railway franchises in Chicago is still far from being settled. He declared that the street railway service of Chicago is inferior to that of cities of 200,000 population.

A report on the work of the committee on municipal accounts and statistics was submitted by Dr. E. M. Hartwell, chairman of the committee, in which he stated that three meetings have been held and a tentative schedule for summaries of municipal receipts and expenditures have been prepared. The scheme proposed involves a grouping of receipts and expenditures under the various municipal departments, besides consolidated statements of receipts and expenditures for the year and an analysis of both ordinary and extraordinary revenue by sources.

One of the schedules, showing receipts and expenditures by departments, has already been used in the report of the city auditor of Newton, Mass., for 1900, through the cooperation of that officer and Mr. Harvey S. Chase of Boston, a member of the committee.

Under the direction of Dr. Hartwell the department of statistics of Boston has undertaken to apply the same schedule to the accounts of that city for 1900. Charles Haskins of New York, another member of the committee, has recommended that the scheme be applied to the accounts of the city of Chicago. Dr. Hartwell suggested that to secure municipal statistics in general the organization of bureaus of municipal statistics, like those of European cities, would be a great help, and that such assistance could be expected from the various organizations closely related to municipal public works.

A paper was presented by Charles Haskins on the confused and confusing condition of the accounts of the city of Chicago, including the many independent boards and taxing bodies within the city limits. He has made a report on the general subject to the Merchants' club of Chicago, which has been printed for distribution.

Dr. John A. Fairlie of the University of Michigan presented a review of public control of municipal accounting in continental Europe, in which he stated France, Italy and Germany have a central audit of mu-

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nicipal accounts, the latter country being weakest in this respect. Summaries of municipal statistics are published by both France and Italy, but those of France go less into detail than those of Italy. Paris has a statistical bureau which issues valuable summaries, both yearly and at more frequent intervals. The German cities publish good municipal statistics, in addition to which a voluntary association of statistical officers publishes a valuable municipal year book, including classified statistics under various heads of from forty-five to fifty-two of the largest cities of the empire. A summary of municipal statistics has been published in Austria for seven years on the cumulative plan.

G. W. W. Hanger, chief clerk of the U. S. department of labor, reviewed the difficulties encountered by the department in the preparation of its statistics of cities of 30,000 and upwards, issued in 1899 and 1900, and now in preparation for 1901. The lack of uniformity between the different cities and between the various departments of the same city, is the greatest of these difficulties. Special assessments for public improvements are the cause of endless trouble in trying to arrive at the expenditure for different purposes. Great confusion is also experienced between the outlays for construction and expenditures for maintenance.

Reports from various members of the conference on uniform municipal accounting, showed that a very complete system of uniform street railway accounting has been adopted by several organizations interested in that subject, and ordered put in use by companies making returns to the State Railroad Commissions of some of the States. A report, with accounting schedules, has been prepared by a committee of the National Electric Light Association, for submission to the annual convention of that body at Niagara Falls, May 21, 22 and 23. An outline plan for both sewerage and paving statistics has been prepared by the American Society of Municipal Improvements. Schedules for summaries of water works statistics were prepared some years ago by committees of the New England and the American Water Works Associations and the American Society of Municipal Improvements. Harvey S. Chase, of Boston, was requested to confer with the commitee of the National Electric Light Association in regard to its proposed scheme of accounting; also to confer with committees dealing with gas accounts and statistics. M. N. Baker, of New York City, was requested to confer with committees charged with securing greater uniformity in the statistics of municipal engineering, and particularly to see what can be done towards the adoption of a common schedule of water works statistics by the American New England and Central States Water Works associations, and the American Society of Municipal Improvements. Progress in this particular is desired before the convention of the American Water Works Association to be held in New York City the latter part of June.

Indiana Municipal League Convention.

The eighth convention of the Indiana Municipal League was held in Columbus, Ind., May 8, 9 and 10. Among the papers submitted was one of unusual interest by James T. Merryman, city attorney of Decatur, on "The New Street Improvement Law," in which he said: "The Barrett law was in part a misnomer, for the reason that it was wholly unlike the original bill, and was held by the Federal court to be unconstitutional, and not a law that could be enforced, in which holding Justice Baker of the Supreme court concurred; but it was upheld by a majority of the State Supreme court, so, in questions arising in State courts, it is the law."

After giving in detail the Barrett law, he said: "I submit it as my humble opinion that if the new act shall be held in any or all particulars invalid, and will not meet the demands for a street improvement law, yet it is a vast improvement over that unutterable nondescript called 'the Barrett law.'"

Hon. George N. Lawrence, mayor of North Vernon, led the discussion following the paper, in which he expressed himself as being favorably inclined toward the Barrett law.

Officers were elected as follows: President, George E. Downey, of Aurora; vice-president, B. F. Deahl, of Goshen, and all mayors members of the league; secretary, Wm. W. Woody, of Anderson; treasurer, L. W. Mellett, of Elwood. J. F. France, city attorney of Huntington, was appointed chairman of the legislative committee and Joseph T. Day, mayor of Dunkirk, chairman of the executive committee. The committee on revision of municipal laws is composed of the following: G. M. Ballard, J. T. Merryman, W. N. Hauck, O. H. Bogue, W. H. Shambaugh and George Voight.

The next meeting will be held in Anderson Oct. 10, 11 and 12.

Technical Meetings.

The twentieth annual convention of the American Street Railway Association will be held in Madison Square Garden, New York City, Oct. 9, 10 and 11.

The Southwestern Gas, Electric and Street Railway Association held its third annual meeting at Houston, Tex., April 19 and 20. Among the papers presented were the following: "Municipal Ownership vs.

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Private Corporations," T. D. Miller, Dallas, Tex.; "Water Power for Small Plants," F. R. Starr, Gonzoles, Tex.; "Corporation and Its Employes," H. F. MacGregor, Houston.

The Canadian Electrical Association will hold its annual meeting at Ottawa, Ont., June 19 to 21. C. H. Mortimer, Secy., Confederation Life Bldg., Toronto.

The annual meeting of the United Electrical Contractors' Association of New York State will be held at Buffalo, July 17. Wells Dygert, Secy., Buffalo.

The Canadian Society of Civil Engineers held a meeting at Montreal May 9, when a paper was read by C. B. Smith on "Discharge of Sewage from Toronto Sewers in 1900."

The League of Ohio Municipalities met in Cleveland May 14, 15 and 16. Among the papers presented were the following: "Predatory Corporations," W. S. Crandall of New York; "Electrolysis of Water and Gas Pipes," E. P. Matthews of Dayton.

Sidewalk Assessment on Property Not Abutting Not Valid.

Judge Carter of the Indiana circuit court rendered a decision May 25, holding that an improvement lien against the property of Elizabeth and Battis Webber, on W. Michigan-st., in Haughville, is invalid. The property fronts on Michigan-st. and is 25 feet east of Germania-ave. Germania-ave. was improved by building a sidewalk, and under certain provisions of the Barrett law an assesment was levied on the Webber property. It was not paid and suit was brought to foreclose an improvement lien. A demurrer to the complaint set up the plea that no assessment could be made on the property, as it received no benefits from the improvemefit, and that the provision of the Barrett law, which says that property at various distances from the improvement may be assessed, did not apply in this case because the assessment on the abutting property had not been exhausted. A brief accompanied the demurrer, arguing that there was a two-story brick building between the Webber property and the improved street, completely shutting off any benefits that would be derived from the improvement. The sidewalk does not at any place touch the property of the defendants. Judge Carter in rendering his decision, followed the decision of the higher court in two similar instances which have declared the assessment invalid.

Asphalt Pavement Prices in Buffalo.

According to newspaper reports the rejection of bids consequent on the decision of the Court of Appeals invalidating the former specifications for asphalt paving in Buffalo on account of the unconstitutionality of the so-called Labor Law in New York, seems to have resulted in a material reduction in prices. No modifications were made in the specifications for the work, but prices per square yard, as computed from the total bids, have been reduced from 25 to 90 cents a square yard below the prices for the same streets in the earlier bids, the usual reduction being between 50 and 60 cents. The prices in the new bids now range from $1.58 to $2.62 a square yard, and the total saving on the nine streets for which bids were received amounts to over $15,000. There is a reduction in the bids for brick pavements on the same streets of about $1,800, less than 12 per cent. of the reduction in the asphalt bids. On four of the streets the German Rock Asphalt company was the lowest bidder, Henry P. Burgard on three, the Warner-Quinlan company on one and the American Contracting company on one. The Interstate Asphalt company, which was the lowest bidder in the next previous letting by $40,000 or more, did not reach the lowest figure on any of these nine streets. If the new prices are correctly computed they are most of them quite low, and at the open market prices for asphalt materials some of them are perhaps too low to warrant the expectation that they will continue to be offered.

American Society of Civil Engineers.

The annual convention of the American Society of Civil Engineers will be held at Niagara Falls, N. Y., June 25 to 28 inclusive. Special railroad rates are announced and free transportation to members and their families between Niagara Falls and Buffalo during the days of the convention.

The successful program of discussions followed for two or three years will be carried out this year as well as the many attractions to the engineer and sight-seer will permit. The questions on the program are:

1. Do the interests of the profession, and the duty of its members to the public, require that only those who are competent be allowed to practice as civil engineers?

Under what authority, through what agency, and upon what evidence of competency, should applicants be admitted to the practice of civil engineering?

2. Steel-Concrete Construction — What stress in tension and compression should be allowed in concrete?

What is the proper modulus of elasticity of concrete?

In Steel-Concrete Arches—What should be the ratio of steel section to concrete section, and what is the best form and disposition of the former?

What consideration should be given to temperature changes and consequent stresses?

What are the best proportions for con-

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crete, and what is the best method of placing it?

3. The Decolorization of Water—When is it necessary? How may it be accomplished?

4. The Consumption of Water in Municipal Supplies, and the Restriction of Waste.

Discussion of any of the society papers of the last six months will also be in order. There will also be an illustrated lecture on some of the engineering features of Niagara, and the pres ent's address.

Municipal Reports.

Annual Report of City Engineer, Supt. of Parks and Health Officer of city of Mankato, Minn., for 1900. J. R. Thompson, Cy. Engr.; Geo. E. Blake, Supt. Parks; Dr. J. S. Holbrook, Health Officer.

Pipe laying for water works by day labor is recommended in this report. A word of warning is also given as to indications of the possible exhaustion of the present water supply. A marked improvement in the amount and kinds of sidewalk laid during the last year is noted in the report. Of the 66,334 sq. ft. laid during the year 61,754 was of cement. City Engineer Thompson states that for the outlying parts of the city he would allow the building of gravel and cinder walks. In connection with the report of the park superintendent some fine views of Sibley Park are given.

Sixth Annual Report of Board of Trustees for Water Works and Improvement Bonds for City of Jacksonville, Fla., for year 1900. R. N. Ellis, C. E., Supt.

The report shows that about one-half of the water service is now under meter, and although 200 services were added during the year 54,856 gallons less per day were pumped than in the previous year; making a per capita consumption of about 71 gallons per day. Mr. Ellis thinks that with all of the taps metered the consumption may be reduced to about 50 or 55 gallons per capita per day. In order to encourage the use of water in beautifying the lawns, a maximum of 300 gallons per day to each service is allowed at a minimum rate of $12 per year.

Eleventh Annual Report of the Water Commissioners of Reading, Mass., for year 1900. L. M. Bancroft, Supt.

This report is almost entirely statistical and in this respect it is quite complete.

Sixth Annual Report of the Board of Water Commissioners of Johnstown, N. Y., for the year 1900. C. C. Abel, Supt.

The commissioners express much gratification over the quality and amount of the water supply of Johnstown. While neighboring towns suffered much from drought in 1900, the reservoirs of Johnstown were constantly filled. On account of the abundance of the supply, meter rates were reduced to encourage larger use of water for commercial purposes and to induce new industries to locate in Johnstown.

Annual Report of the City Engineer, Minneapolis, Minn., 1900, G. W. Sublette, City Engineer.

During 1900 there was expended under the direction of the city engineer $153,137.96 for paving, $27,793.89 for curb and gutter, $177,569.67 for sewers, $73,195.43 upon the water system, $156,460.75 for stone sidewalks, $14,981.85 for bridges and viaducts, $43,135.25 for street sweeping and cleaning, $108,378.11 for street sprinkling, and other items, bringing the total to $886,236.36 for the year. The engineer's expenses for taking care of this work were $26,495.48. A table of sewers constructed shows the details of size, kind, shape, length, appurtenances, depth and width and cubic yards of excavation and cost of sewer and catchbasins, also a statement of the kind of excavation, making a judgment upon the work comparatively easy. The cements tested are reported giving detailed results of tests and chemical analyses, thus making a valuable comparison for both natural and Portland cements. A comparison of cost of pump repairs per million gallons pumped for the three water pumping stations is made, showing their relative efficiency. A new garbage crematory was constructed.

Eleventh Annual Report of the Board of Water Commissioners of the City of Gloversville, N. Y. Alexander Orr, C. E., Supt.

This is one of the New York towns that has difficulty during certain seasons in maintaining the supply of water. During the last year it was able to meet the demands, except during September and October.

Annual Report of the City Officers of Bessemer, Ala., for the Year 1900. Thos. T. Huey, Mayor.

Initial steps are being taken for the improvement of the city. Much of the report is devoted to the presentation of facts bearing upon the importance of lighting, paving and sewerage, and recommendations are made as to financial means for securing such improvements.

Annual Report of the City Engineer of Providence, R. I., 1900. Otis F. Clapp, City Engineer.

The report shows 6.85 miles of water mains laid, 5.32 miles of sewers, 0.315 miles of streets paved. The average cost of water mains laid, with iron at $35 per long ton, is given as

For 4-inch	.....	$0.556 per foot
" 6	.....	0.815 "
" 8	.....	1.098 "
" 10	.....	1.408 "
" 12	.....	1.809 "
" 16	.....	2.730 "
" 20	.....	3.817 "
" 24	.....	5.052 "
" 30	.....	7.195 "
" 36	.....	9.683 "

The revenue from the water works was $554,149, the cost of operation, $73,843. The

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consumption per capita was 54 gallons. A full description of the operation of the recently completed sewage precipitation plant is given, the chemical process being used.

Ninth Annual Report of the Department of Public Works and the Second Annual Report of the Board of Local Improvements of Peoria, Ill. Joseph Elder, Commissioner of Public Works; Harry E. Beasley, City Engineer; John W. Rowcliff, Superintendent of Streets.

The report shows 8.4 miles of sidewalks constructed during the year 1900, about three-fourths being brick and one-fifth cement; 2.18 miles of pavement, mostly brick, with about one-fourth mile each of asphalt and novaculite. A detailed statement and a summary of cement tests is given, making comparisons of cement easy; also a summary of brick tests for the various streets constructed and brick used.

The city is now relieved from its drawback for several years in being classed as a city of less than 50,000, since the 1900 census showed 58,000, and can now proceed more rapidly with many improvements.

Reports of Departments of City of Nashville, Tenn. 1900. J. M. Head, Mayor. W. M. Leftwich, jr., City Engineer.

The gas company's franchise expired and was renewed for twenty-five years, beginning May, 1900, under an agreement for a maximum charge of $1.00 per 1,000 cu. ft. The water works income of $145,216.08 was sufficient to pay all expenses and furnish the city with water for public purposes free. The garbage disposal question is a prominent one. The city health officer's report shows a commendable activity. The city has done but little street, sewer, or water main extension owing to a present lack of funds.

Annual Report of the City Engineer of St. Paul, Minn., 1900. O. Claussen, City Engr.

Under the new charter this department is independent of the department of public works, and has charge of sidewalks, streets, bridges, levees, sewers, etc., and hereafter will have charge of garbage collection and disposal. Maintenance of streets and sewers cost $150,296.08, 80 per cent. being for material. Asphalt streets were washed at a cost of $13.52 per night for 1.64 miles. The average cost per night for sweeping an average of 115,439 sq. yds. of pavement was $50.83 by machines. The average cost per day for streets swept by hand was $114.94, the amount varying from 315,080 sq. yds. at the beginning of the season to 355,131 sq. yds. at the end, and there being 184 working days. The total cost of grading, paving and sidewalks and sprinkling for the year was $320,909.90, the principal items being $100,092.86 for asphalt paving, $49,129 for sprinkling, about $30,000 each for wood and cement walks, for sewers and for brick paving. The cost of inspection was 2 per cent. of the amount expended. Summaries of Portland and natural cement tests for various brands used are tabulated.

Eighth Annual Report of the City of Rutland, Vt., 1900. John D. Spellman, Mayor; A. C. Grover, Cy. engr. and supt. sts. and water works.

The mayor's report shows an unfortunate difference between the two officials named which has prevented some work and made other work difficult. About 8,000 ft. of street has been macadamized, 7,000 ft. of pipe sewer built, one-half mile of new concrete sidewalks constructed and the same amount resurfaced. The maintenance and construction of streets, sewers and sidewalks has cost $22,960. Water works maintenance has cost $5,731.23.

Eighth Annual Report of the Engineering Department of the City of New Bedford, Mass. Wm. F. Williams, City Engineer.

About 4,000 feet of pipe sewer have been contracted at a cost of $7,181.33. A large amount of the work has been done for various city departments, statement of the nature of which is made, but no figures of amount or cost. The engineering department seems to have cost $7,991 for the year.

Ninth Annual Report of the Board of Water Commissioners of the City of Haverhill, Mass. D. H. Gilderson, Supt.

The large new work of the year has been the completion of the new station at Kenoza Lake, at a total cost of about $55,000, and the laying of a new 20-in. main. The maintenance charges for the year have been $19,281.26. The general new construction has cost $8,275.06, and $29,699 was paid on the special new construction mentioned. The revenue for the year was $87,546.45.

Personal Notes.

Frank Frary has been elected mayor at San Diego, Cal.

W. M. Hay has been appointed city engineer at De Kalb, Ill.

J. L. Evans has been appointed city engineer at Bakersfield, Cal.

Henry J. Connelly has been appointed city engineer at Racine, Wis.

William Kuhlman has been elected president of the water board at Toledo, O.

James M. Van Auken has been appointed city engineer for one year at Bellefontaine, O.

Stokey D. Rowan was re-elected city engineer, May 4, at McMinnville, Tenn. This is Mr. Rowan's third term in the position.

John E. Edwards, chief engineer of the Detroit water works for thirty-two years, died at his home in that city, aged eighty years.

Frank L. Marston, city engineer of Bangor, Me., has established offices in the Bass building at Bangor, where he will practice civil engineering.

William J. Carter, Assoc. M. Am. Soc. C. E., has been appointed city engineer at Cleveland, O., to succeed James Ritchie.

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Mr. Carter was formerly superintendent of construction for the government at Ft. Preble, Me. James T. Pardee has been appointed first assistant engineer.

Andrew E. Foye, formerly acting chief engineer of the department of highways of Greater New York, has been appointed chief engineer of that department.

Hon. Patrick J. Gleason, former mayor of Long Island City, died in his home in that city May 20 of heart disease, aged about seventy years. Mr. Gleason was mayor from 1887 to 1893. In that year H. S. Sanford defeated him, but the police had to eject Gleason from the City Hall before Sanford could take his office. The courts decided against Gleason. In 1896 he again became mayor, but was legislated out of office when Greater New York was incorporated.

DIRECTORY OF AMERICAN CEMENT INDUSTRIES AND HAND-BOOK FOR CEMENT USERS.

This book, which has been in active preparation for five months by Municipal Engineering Company, under the direction of Charles Carroll Brown, M. Am. Soc. C. E., is out of press. Every effort has been made to make the book as complete as its plan required, and as correct as possible, and to issue it promptly that it might be in use during the present season.

Of its 645 pages the first 240 are of direct practical everyday interest to the user of cement, the supervisor of its use, the engineer or architect preparing specifications for its use. The chapter on Testing of Cement, giving the most appproved methods of determining the relative value of brands and of shipments of cement, is followed by one giving approved examples of the best specifications for the acceptance or rejection of cement, all kinds of cement work being included. Various kinds of railroad work, concrete and steel combination structures, walls and docks, subways, pavements and sewers, foundations, sidewalks and floors and buildings require specifications of different form and quality. All these kinds of work are represented by standard specifications, and allied works not mentioned can be brought under one or more of the classes of specifications given.

A short chapter on the Uses of Cement gives some idea of the great variety of work in which cement and cement concrete can be used, and will point to new uses. It is followed by a very valuable chapter giving specifications for the Use of Cement in all classes of work. The chapter begins with the high class concrete required for concrete and steel arch construction, and several examples of the specifications accepted in the very best practice are given, the various conditions under which work must be done being fully exemplified. These specifications include the requirements for the work auxiliary to the cement work, which is inseparable therefrom, so that the general specifications for the whole work are included with the specifications for the cement and concrete work. Railroad specifications, giving examples for the best practice in this class of work, include details of specifications for the various materials required and the methods of mixing them and laying in piers, foundations, walls, culverts and buildings. Very full specifications for cement walks are provided, those of many different cities being put in comparison, so that the method of construction for almost every possible condition is fully described. The construction of cement curbing and gutter is quite as fully specified. Street crossings, driveways, concrete floors for various conditions, stairways, all receive full consideration. Mortar and concrete, with both natural and Portland cement, for sewers, foundations and masonry in municipal work, as specified by various cities, are fuly described, and the specifications include the entire work in which the cement is used.

Several full specifications for concrete mixing are given, making a selection for any given condition easy. Many specifications for special uses of cement, such as fillers for brick pavements, stucco, plastering for cisterns, catch basins and walls, water-tight mortar, artificial stone and pipe, lining of ditches, Monier and other composite constructions, fire-proof concrete, are given in full, as well as concrete for special foundations and other special uses. This chapter covers more than fifty pages.

The chapter on Data for Estimates or Cement Work gives weights, measurements, results of observations of actual quantities used, proportions of materials, etc., sufficient to make computations of quantities of all materials convenient. In connection with this chapter about twelve pages of the Chapter on Uses of Cement should be used for computations of cement concrete.

These chapters take nearly 150 pages and are a compilation of the best practice in all kinds of cement work and a guide to all the common uses of cement and concrete.

The features in the later chapters and Directory lists are not to be found in any other publication.

The table giving freight rates on cement

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and the short chapter accompanying it are of much interest and value. Though subject to the constant fluctuations of rates up and down from those quoted, it can be used safely as a basis for comparisons and as a check upon charges and quotations which include payment of freight.

The largest chapter in the book is that giving descriptions of works and processes of making cement, which covers nearly ninety pages. A few descriptions of processes and of cement factories have appeared in various periodicals and society proceedings, but they have heretofore not been available in permanent form. It was impossible and quite unnecessary for the purpose of the user of this book to go into the minute details of the construction of factories, and most companies very properly object to the publication of the details of their economies in working. Each of the processes of making cement is described at least once in this chapter, to give a clear idea of it and of the character of the product which may rightfully be expected of it, so that the reader of the chapter can soon form a judgment upon this point. The descriptions of other works are reduced to save space and repetition, but are full enough to give satisfaction when used in conjunction with the fuller descriptions of the same processes occurring elsewhere in the chapter. When descriptions have not been available the reasons are given individually or by reference to notes on page 152. A careful study of the chapter will aid one to compare the various processes and mechanical methods and form some idea of the best results which can be secured from them; to estimate the relative value of expert services in the various processes and in running the various machinery and be in position to compare possible results from factories using the various processes and machinery. A comparison of materials is an important item to be considered in making this judgment and data on this point are given in the descriptions of the works in more or less detail. A comparison of the products by the methods described in the chapter on Testing Cement will show how closely the works approach the quality possible, and thus a judgment of the care used in making the cement or of the adulterations of the sample examined can be formed. The chapter includes some notice of practically every Portland cement plant in operation in the United States, and of some which are nearing completion, and of nearly all the natural hydraulic cement plants.

The Directory begins properly on page 240 with the list of cement manufacturers, giving the same list of companies appearing in the chapter on Descriptions of Works and Processes, with some additions, their location, officers, capitalization, capacity, kinds and brands of cement manufactured and the railroads on which the plants are located. The Directory lists are all up to date, practically every item having been obtained directly from the city named since Jan. 1, 1901. The proportion of cities and town of more than 2,000 population not represented in these lists is small, and it is confidently belived that the names are correct and representative of their respective classes.

The list of cement dealers is of value to manufacturers and sales agents of cement and will be found convenient for contractors, engineers and others considering contracts on the purchase of cement at a distance from home. It is the source of information for the prospective purchaser of cement.

The list of contractors and large users of cement is almost equally valuable to the cement manufacturers and sales agents and is of use to cement dealers. Engineers and architects will also find use for the list, as well as large contractors.

The list of engineers, architects and others supervising the use of cement is of value to manufacturers, sales agents, dealers, contractors, as well as to persons and corporations contemplating work and desiring expert assistance. It is especially full in the list of city engineers, which list is correct for the first quarter of 1901.

The list of workers in cement includes as far as possible the practical users of cement who work on and furnish materials for their own contracts. It has not been possible in cities to separate such men from those simply in the employment of contractors. In the large cities they are nearly all included in the list of contractors and they do not appear in this list.

The list of manufacturers and dealers in machinery for cement mills and machinery and tools for cement users is a convenient list of reference for cement manufacturers, large users of cement and cement contractors and workers. The many capitalists considering investment in new cement plants will find this list convenient.

The list of dealers in lime and plaster, of lime manufacturers and of plaster manufacturers were decided upon after the book was nearly completed. The list of dealers is a valuable supplement to the list of dealers in cement, the two together givivng a very complete list of the dealers in lime and plaster throughout the country in towns and cities of 2,000 population or more.

The value of the lists of manufacturers of lime and plaster is like that of the manufacturers of cement to engineers, architects, dealers and contractors.

A full index makes it easy to find any desired item in the book.

The price of the book is $5.00 per copy, express charges prepaid.

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SELECTIONS FROM THE PRESS.

Tar Macadam Pavement.

It is well known that crushed granite and quartzite, which contain high percentages of quartz and in which the individual grains interlock in an intricate manner, are the very best kinds of rock for resisting abrasion when used in the construction of macadam roadways. However, it is equally well known that when used alone difficulty is constantly experienced in packing the surface with the street roller. Experience has shown that when these rocks are used alone the only way to make a satisfactory road is to thoroughly soak each layer with water and pack it with a roller weighing not over ten tons. In most instances it has been found advantageous to mix a small percentage of limestone screenings with the granite or quartzite to assist in bonding the surface. A small quantity of clay is also sometimes used with the topmost layer of screenings. The limestone screenings and clay assist in uniting the rock fragments together furnishing a compact, impervious bed.

In some cities the granite and quartzite are each used without the addition of either limestone screenings or clay. The bed of the road, however, remains loose and porous for some time after it has been constructed or until the constant traffic has settled and compressed the different layers. After several years there is no appreciable difference between streets which have been constructed out of granite and limestone screenings and those constructed out of granite alone.

A street which is constructed out of granite or quartzite requires more careful and continued rolling than a street which is constructed out of limestone rock. The latter may be rolled with a heavy roller for a short time and be thoroughly compacted while the former must be rolled with a light roller for a long period before being satisfactory. On the other hand roads constructed out of granite and quartzite will wear longer and cost much less for repair, cleaning, sprinkling, etc., than those built out of limestone.

Where a macadam roadway is to be constructed it is eminently desirable that the best wearing material should be used, providing it can be packed so as to give a smooth surface which will shed the water. To accomplish this, many experiments have been made to use granite and quartzite by adding a small percentage of another material to give it the desired bonding capacity. The latest and perhaps the most attractive pavement which has been built, with this end in view, is what is known as "tar macadam." This pavement is really a cross between an asphalt pavement and macadam. In the construction of asphalt pavement the principal constituent of the wearing surface is sharp, angular sand and asphalt. In the wearing surface of the tar macadam the principal material is quartzite or a hard granite rock. The tar is used simply as a part of the wearing surface of the pavement. The wearing capacity of the tar macadam is measured entirely by the hardness and strength of the rock out of which it is composed, only sufficient tar being used to unite the fragments into a solid uniform mass.

Up to the present time these pavements have been built more extensively in Canada than in this country. Toronto, Ottawa and London, in the province of Ontario, have been building pavements of this character for several years. I am informed that in Fredonia and Aurora, N. Y., tar macadam pavements have also been constructed.

The following are the specifications for tar macadam roadways as constructed in London, Ontario. They were kindly furnished me by Mr. Ormsby Graydon, C. E., O. L. S., city engineer of London:

"The earth shall be excavated and blocks removed to a depth of twelve inches below the line of finished grade. This foundation shall be thoroughly wetted and rolled with heavy horse rollers.

"Upon the above foundation shall be placed six inches of clean, coarse gravel, said gravel to conform with the cross section and finished grade of the street, and shall be wetted and rolled with a steam roller. Upon said foundation of granite when thoroughly rolled shall then be placed three inches of coarse-grained, hard crushed stone capable of passing through a 1½-inch ring, 20 per cent. of which being fine crushed and capable of passing through a ½-inch ring. The above crushed stone shall be heated on a steel platform in pans to 120 degrees F. and on this heated, crushed stone, tar composition shall be poured until thoroughly covered, the tar to be heated to the boiling point, 212 degrees F., and the pitch to about 240 degrees, the whole to be thoroughly mixed in the same manner as concrete is mixed.

"After thoroughly mixing the same it shall be hauled on the street and graded evenly to the required depth; then rolled with a hand roller, after which it must be rolled with steam roller.

"When thoroughly rolled, a second course two inches in depth of crushed stone capable of passing through a 1½ and 1-inch ring,

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respectively, will be mixed in the same manner as above, as regards heat, mixture, application, etc., but shall only be rolled with the hand roller.

"Upon this second course shall then be spread the finishing coat one inch in thickness, composed of a thorough mixture of sand, pitch and tar; sand to be thoroughly dried and to be heated to at least 120 degrees F. This coat shall then be applied while hot and spread evenly to the proper thickness, and rolled with the hand roller. After which the whole pavement shall be thoroughly rolled with a steam roller, and sanded with dry sand one-half inch in depth.

"Tar is to be heated 212 degrees F. and pitch 240 degrees and properly mixed at a rate of ten gallons of tar to one gallon of pitch per cubic yard of crushed stone; eleven gallons of tar to one of pitch per cubic yard of top coat.

"Stone must be good and hard; no limestone will be allowed.

"Coal gas tar shall be clean, containing no water gas tar. Pitch shall also be the best of its kind, manufacturing from pure coal gas tar."

E. B. Wingate, city engineer of Hamilton, also furnished me with specifications for tar macadam roadways as constructed in that city. The following is a copy of these specifications:

"All earth or other material above the sub-grade shall be excavated, so as to conform to the level of the sub-grade, which will be ten inches below the finished surface of the roadway; and should the sub-grade be above the level of the natural ground, then earth shall be deposited until the level of the sub-grade is reached. The sub-grade shall be shaped to the profile and cross section which will be furnished by the city engineer.

"After the sub-grade has been formed to the proper camber of the road, generally one-half inch per foot or 6 inches for 24-foot roadway, to be thoroughly rolled with the steam roller, and if by this means soft spots are revealed, they shall be filled with good solid material.

"The first six inches shall be made in the ordinary way for a macadam or telford roadway thoroughly rolled. If so required, it may be made of hard broken stone, furnace clinkers, or brick rolled smooth and finished to the required camber of the road. Upon this shall be placed the tarred stone. The first layer, three inches of hand broken stone to pass through a 2½-inch ring, then a two-inch layer of machine broken stone, the whole smoothed off with a hand roller and after top dressing is applied thoroughly rolled with a steam roller. On this a layer fo fine gravel and quarry chippings, mixed in equal proportions, three-quarters inch thick, shall be placed, and well rolled in so as to fill all interstices. Before finishing, a dressing of stone screenings for the purpose of coloring shall be scattered broadcast to be worked in by the traffic. All layers, including the coloring layer, shall be thoroughly compacted by rolling.

"The stone to be tarred shall, if moist, be heated on an iron floor, under which are flues from a fire, until the moisture is driven out. The material in its heated state is then thoroughly mixed with a sufficient quantity of tar. The broken stone in warm weather may be sun dried, but in all cases the finer course must be artificially dried. At the same time care must be taken not to get this material too hot. The tar should be boiled in iron kettles holding one hundred imperial gallons Eight imperial gallons should be added to each cubic yard of the coarser material or more if required to completely cover the stone, and seventeen to eighteen gallons to the finer kind of stone.

"The tar must be pure coal tar free from all foreign substances and containing not more than 5 per cent. of water and shall contain upon analysis not less than 56 per cent. pitch.

"The work must be done in the summer months, and all work must be suspended during wet weather."

The roadways in these cities have not been in use a sufficient length of time for any one to give definite information as to their suitability for city pavements. It was also impossible for me to obtain information concerning the probable cost of cleaning, repairing and sprinkling these pavements.

In Hamilton, Ontario, this pavement cost about 95c per square yard, the same being based upon the coal tar at $3.75 per barrel, laid down in Hamilton, and labor at 18c per hour. City Engineer Wingate, of that place, writes that he has every reason to believe that the annual cost of repairs would not exceed 6c per square yard.

City Engineer Graydon, of London, Ontario, writes me that the pavements which they have laid cost $1.20 per square yard. He says the only caution to be observed in laying this pavement is to have an inspector see that the specifications are carried out to the letter. His remark that "eternal vigilance is the only way to get good work." might be followed with profit

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by some Wisconsin inspectors of street work.

City Engineer Rust, of Toronto, Ontario, says that the tar macadam roadways which are being constructed in that city are costing from $1.30 to $1.40 per square yard. The tar macadam streets constructed in this city consist first, of a layer of broken stone 4 inches in depth which is thoroughly wetted and rolled as for an ordinary macadam roadway. On the top of this is laid a course of tarred stone, 4 inches in depth, upon which is a dressing of ¾-inch of fine granite chippings and gravel, which are also mixed with tar, the whole being rolled with steam roller. This construction is simple and should be carefully considered by anyone contemplating using tar-macadam as a pavement.

In some sections of Wisconsin there occur vast quantities of quartzite and granite, both of which have been considered unsuitable for macadam pavements on account of the difficulty experienced in packing the rock firmly on the streets on which it has been used. In a number of important instances these deposits of quartzite and granits occur in localities where other materials for street pavements are very scarce. I am inclined to believe that the tar macadam pavement which has been tried in Canadian cities and which has all the appearance of being well adapted to the light traffic of certain sections of this state, could be used advantageously in many municipalities where the expense of constructing asphalt or brick pavements is retarding the improvement of the highways.

Necedah, for example, is situated in the midst of a vast area of marsh and prairie land, from which occasional hills of sandstone and quartzite rise to relieve the general monotony of the landscape. The approaches to the city are, in some cases, over roads which are beds of sand for miles and miles. The only stone easily available for improving these sandy stretches of road is the quartzite which occurs at Necedah in unlimited quantities almost within the city limits. For the city itself the quartzite might be used by crushing and mixing with tar to form a "tar-macadam" pavement. For the country roads the quartzite could be used advantageously without the tar.

The quartzite rocks of Necedah are in the midst of a region in which suitable stone for road construction is scarce. Sparta, Tomah, Viroqua, Mauston, New Lisbon and other cities of this region might do well to carefully investigate the possibility of obtaining this rock and using it in the construction of tar-macadam pavements. It stands to reason that this pavement, if properly constructed, ought to be not only much less expensive than asphalt but equally as durable.

Use of Concrete on Railroads.

The following discussion is taken from the report of the consideration of the use of concrete in railroad work by the American Railway Engineering and Maintenance of Way Association at its Chicago meeting March 12, 13 and 14, and shows the growing popularity of the material:

President Wallace—The large amount of monolithic concrete work which has been constructed on various roads, particularly in the Middle West in the last ten years, it would seem to me would make the experience of our members interesting.

Mr. G. A. Mountain, Chief Engineer Canada Atlantic—"I want to say a few words about the comparative cost of masonry and concrete. We are doing lots of work in concrete, which, in the old days, would cost an average of $8 per cubic yard for masonry. We have wooden trestles which have about reached their limit of age. We simply make a model, usually dressed lumber on the inside, to make a better facing, and put in our concrete. We find that hauling the cement 200 or 300 miles, getting the sand in close vicinity and the labor at $1.25 a day, we can put in this concrete at about $5 a cubic yard. There are cases where the center bent of the trestle must be buried in concrete. That is very easily done, whereas with masonry you have all these timbers cut out. We would not think of going back to masonry. I would like to have the committee go into the question of the specification of concrete, as to the different quantities to use. Our experience with brick pipe culverts in a northern country is that the frost tears them to pieces; brick pipe culverts 3 ft. in diam. have had to come out. Whether that was an inferior brick or not, I don't know.

President Wallace—The brick piers on the Illinois Central south of the Ohio River have been in service over 40 years. We use brick for the walls of culverts almost entirely south of the river and concrete almost entirely north.

Mr. C. Dougherty, Roadmaster, Illinois Central—We have on the division with which I am connected two concrete arches, where we have been doing double track work, taking out an iron span, a single

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track span, and replacing it with duplicate brick concrete arches. One of these arches is 40 feet. in diam. The other is a combination of a 38-ft. arch and a 10-ft. arch. The thickness of the concrete at the top of the arch, I think, is 27 in. These culverts were completed last season and so far have been holding up very well.

Mr. George Houliston, Division Engineer Western New York & Pennsylvania Railroad—I had charge last summer of the construction of a double track tunnel of concrete for the State Commission of Massachusetts, horseshoe tunnel, a soft clay, with considerable water in it. The outside ring was laid 6 in. and lined with asphalt to keep the water out, and then the balance of the concrete, about 2 ft., was laid inside. It made a very exact piece of work. The section we had was about a thousand feet long, and it is very satisfactory. Our work cost $7.13 a yard laid in this somewhat expensive way. The proportion was 1, 2 and 5, in Portland cement. Some shrinkage cracks have been noticed in the work laid in the hot summer months.

Mr. J. Dunn. Chief Engineer of the Atchison, Topeka & Santa Fe—We have been using concrete rather extensively, and particularly in small culverts, owing to the higher price of iron pipe, and we have found numerous cases where the concrete was more economical, but we have no very large structures of concrete. Stone is generally cheap, and we have used vitrified brick and the results have been very satisfactory. In the joint track elevation work at Sixteenth and Clark-sts., in Chicago, there was a very large amount of concrete used, some 18,000 yards, and that has proved, I think, better than it would have been if it had been first-class masonry; and it would have been impossible to build masonry there, owing to the contracted nature of the work. I believe the result of our experience shows good Portland cement concrete is equal to the best first-class masonry, and probably better than most of it.

President Wallace—The use of concrete on the Illinois Central has extended over the last ten years, and I think that its value depends, first, on the cement, and, secondly, the honesty in the use and mixing of the material. With care taken in those two things, a first class article of cement and honest and careful mixing, the result has been first-class, and the cost has been obtained at half to one-third what cut stone would have cost us in the same locality.

Mr. G. W. Kittridge, Chief Engineer Cleveland, Cincinnati, Chicago & St. Louis—The Big Four has used concrete construction very largely during the last three years. In fact, there has hardly been a piece of cut stone work, first-class stone work, done on the road during the last three years. The largest piece of work was the construction of a double-arch bridge, which was extended for double-track purposes, each span of which was thirty-four feet in diameter. There was something like 1,200 cubic yards of concrete in these arches and in the wing walls, and the wing walls and the lower part of the structure were built with Louisville cement for the core, with a Portland cement facing of about six inches, and the arches were made of all Portland cement, using the American Portland. The cost of that work complete, exclusive of the preparation of the foundation, which, of course, varies with every structure, was $4.23 a cubic yard. That included all the cost of handling the material and the work, but did not include freight charges on the material over our own line. The cement was hauled free about 250 miles; the broken stone was hauled free about eighty or ninety miles. We made a charge for the timber that went in the centers and into the frames. We have done a great deal of smaller work than that, but that is the largest piece of arch work we have done.

Mr. W. K. McFarlin, chief engineer, Delaware, Lackawanna & Western—"We put in two quite interesting pieces of concrete work this last winter, one over the Hackensack river in New Jersey, a river about 57 ft. deep, and with about 35 ft. of mud on the bottom of that. It is a navigable stream, of course, and we put in a draw span 220 ft. long, all on concrete foundation. We cut off the piles 40 ft. under the water, and sunk the caissons by filling with concrete. There were 4,000 yds. of concrete in the two abutments, one center pier and four rest piers for the ends of the spans. There were 4,050 yds., as I remember it, of concrete, and we used 4,900 bbls. of cement. That was mixed with trap rock and Long Island sand.

"Another piece of masonry is just completed at Buffalo. We had a draw bridge there in 17 ft. of water, rock bottom. It is a pretty busy piece of track, and I should judge they handle 150 to 200 cars of coal a day over it. We began the 1st of December to put in the masonry. It is completed now and the iron work is being erected. We dredged down to rock, put a frame down on the rock with guides, and put the concrete in in sacks. We did no pumping, and put in 12,000 sacks of concrete. This is now

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complete, and it looks first rate. That work only cost about $5.50 a yard, not including the switching. We mixed practically a barrel to the yard, and there will be no question about whether it will stand or not. We can tell that now. When we got to the top of the water, it was about 15 below zero. We brought up the frame and put a house over it and put a stove in it and finished the work in a hot house, so the frost never touched the work."

Mr. I. O. Walker, Division Engineer Nashville, Chattanooga & St. Louis Railway—We have just completed a street culvert under a bridge which is 65 ft. high. The concrete arch is 18 ft. 2 in. from the foundation to the crown of the arch inside. The first problem we struck in building was that the outside dimensions were too great to get in between any spans in the trestle, and we got around this by building one span of the trestle right on the arch. In other words, the actual line of the arch coincides with the bent of the trestle, and the arch is high enough so that the crown of the arch came above what is ordinarily called the pile cap of the trestle. It is a frame trestle, and the piles in the lower bent are about 15 ft. from the ground. We left the posts of the trestle in place and boxed around them; after removing the boxes, the concrete lacked about 2 in. of touching these posts anywhere. In the spring, we are going to finish filling over this arch, and we propose to remove the posts and fill the holes with concrete. The cement used was Louisville in the foundation, and about 30 in. of Louisville around the top of the piling, and the body of the arch up to the springing line is composed of Old Dominion cement, 1, 2 and 5, and above is Portland cement, mixed 1, 2 and 6. The whole structure is faced with 2 in. of German Portland cement, mixed 1 of cement and 2 sand, and this was carefully rammed in place just ahead of the rock concrete, so we got a very successful connection between this facing and the concrete proper.

Mr. H. McDonald, Chief Engineer Nashville, Chattanooga & St. Louis—The principal questions that present themselves to me are whether the quality of the cement could be determined by an inspection on the ground as the work progresses or at the point of manufacture. Our president has suggested that the principal thing was the quality of Portland cement, but a novice in the testing of cement will find that he has a good deal of trouble in telling whether it is properly tested or not. The next question of importance is the sand. The quality is not so important, provided it is durable and has sharp edges. The most instructive points, it seems to me, are failures, and while members are rather reticent about talking about failures they are very free about telling us about their successes.

Among some of the failures I have heard of are the absolute inability to secure a uniform junction between Portland cement and natural cement. In other words, it has been attempted to get a core of natural cement and an exterior of Portland cement, but so far as I have heard the matter has never been successful, and I think the present practice is to use a leaner material in the body and face it with a richer mixture.

Then another difficulty is the treatment of the faces, or how to obliterate the markings of the molds, the treatment of it afterward, whether to chip it off and polish it smooth or cut it, and what to cut it with. All those matters are points which I think the association will be very glad to be enlightened on, and it is possible that the committee has collected data from the various roads as to what their practice has been, and I hope the committee will publish, as an appendix to this report, such data as they have collected and which they think will be of interest.

Mr. H. W. Parkhurst, Engineer of Bridges, Illinois Central—During the last year in double track work on our line between here and Cairo we had in the original track at two points bridges of about 80-ft. span. The waterway in each case was largely in excess of the actual need, and the idea occurred to some of our engineering department to substitute concrete masonry in place of the iron bridges. In the one case the depth from grade line to the ordinary low water of the stream was rather more than 40 ft.; in the other about 26 or 28 ft. In the latter case there was a roadway passing through under the original bridge, as well as the stream. We have replaced the bridge with a double concrete arch, one 36-ft. span built for double track, a substantial pier nearly as heavy as would be required for an abutment, and an arch of 10 ft. for the roadway. At each end of the parapet the usual wing walls, built at an angle of about 30 degrees with the axis of the arch, are constructed, and these are of sufficient thickness to stand the thrust of the embankments. There is only about 3 ft. of fill on the top of the crown of the arch under the ballast; I think 3 ft. including the ballasting. The arch has been completed and the double track was finished over it late last fall, and it has beeen in operation ever since. It was built of Portland cement concrete with nat-

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ural cement concrete in the foundation. We found a very substantial, almost stratified clay beneath the original masonry and adjacent to it, so we got a very good foundation without piling.

In the other case a 40-ft. full center arch was made about 6 ft. in hight and about 12 ft. of fill on the crown of the arch. That work was completed in December of last year. It became quite a problem to judge whether it would be safe before spring to permit the loaded trains and filling to be placed upon the arch, and to assist in determining this briquettes were made and tested from time to time to see the rate of setting. It was found that at the end of, say, four to six weeks, these briquettes, exposed to freezing and thawing, had from about 70 to 75 per cent. of the strength of similar briquettes that were exposed to the ordinary temperature of a warm room, say 65 to 70 deg. The setting seemed to proceed in spite of cold weather. We were able to complete the concrete of this large arch before there was any freezing weather. I think the lowest temperature we had was 20 to 24 deg., for one day only, so that we were pretty sure the concrete had thoroughly set before any loads were imposed upon it. It seems to do its duty without any trouble. I think that the crown of the arch was 3 ft. 9 in. for the 40-ft. arch, and 3 ft. 3 in. for the 36-ft. arch.

The testing itself was in line with the average testing that is going on throughout the country. We had to develop our own specifications. We started with a specification that was a very common one, simply stating the cement was to be of a certain tensile strength, and was to be sound. We gradually evolved a set of tests and requirements that, as the mills met them, we kept increasing. Our idea was to have as high a requirement as we could get the mills to come up to, and not increase the cost to ourselves for cement. We found we were greatly aided by a very ambitious corps of inspectors at the mills, and a very good grade of cement could be had at no extra cost.

The requirements were the usual ones of certain tensile strength, both neat and with sand, that it should pass a boiling test, that it should show a constancy of volume, and that it should have a certain degree of fineness.

A one-day test is really of no value at all for Portland cement, and it is a very hard thing to get a seven and 28-day test if you are testing it in the field. But in the mill there is plenty of time to get a 28-day test. A seven-day test should have a certain strength, which need not be high, with a good percentage of increase. If we were to get up another specification we would make the requirement that there should be a certain stated strength at the end of seven days, with 25 per cent. increase in 28 days.

A great many of the mills make loud complaints about the boiling test. In fact, there was some talk of the American cement mills combining against any such test last year. It was at a period when the American cements were selling at over $2 a barrel, and they claimed they would not sell to any one that specified the boiling test. When their cement went down to $1.60 you would find any mill very glad to meet the boiling test. Some people claim they see no connection between the boiling test and the results of the cement in practice. It may be merely a coincidence, but if so I will give it for what it is worth. We have found close comparison between our boiling test and the way the cement shows up in work. Where this work shows up poorly it has been from cement that did not stand the boiling test. We have had cement that did not stand the boiling test that has shown up all right, but I do not know of any case the other way.

For fineness of grinding we find our greatest trouble, and the boiling test is very closely connected with that. A cement that is finely ground usually boils fairly well and gives high strength with sand. It is altogether a matter of management at the mill. Nearly all American Portland cements are now ground very fine, and will meet a requirement of 95 to 97 per cent. on a 100 sieve. But the natural cements have not come to any such degree of fine grinding as that. There is no reason why a natural cement should not be ground as fine as Portland. The fineness is about the most important element in the cement. The finer it is the coarser the engineer can mix it with sand and stone, therefore having a stronger cement or purer mixture.

The cost of conducting the work such as I have mentioned depends upon the amount of testing that you do. I can give you pretty accurate figures to show what it costs per briquette that is made up in the laboratory. That cost is very constant and that is made up with a force working full time, and it will cost you a litttle over 7½ cents a briquette. That includes a little experimental work and boiling. With a force working about half time we found it costs us about 11 cents a briquette. We test about one briquette for every two barrels, so that the cost in the laboratory was between 3 and 4 cents, as a rule, for us per barrel of cement used. Where we were sending out every day from a single mill we brought the total expense to us for material, sampling and inspecting and testing at a central laboratory, including interest on the first cost and stationery and every incidental expense that could at all be connected with it, up to about 6 cents a barrel on the average run of the cement that we used for two years.—R. R. Gazette.

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MACHINERY AND TRADE.

A Modern Asphalt Refining Plant.

The Trinidad Asphalt Mfg. company of St. Louis, Mo., has now operated the refining plant shown in the accompanying illustration for nearly a year with success. It is equipped with the most modern methods for the refining of asphalt including what is known as the gravity process, and produces a product which is shown by expert analysis to be practically pure. The process used is new and original and has now had a test for a sufficient period to show its value.

Studebaker Sprinklers at the Pan-American Exposition.

The Studebaker Bros. Mfg. company of South Bend, Ind., will have several interesting exhibits at the Pan-American Exposition; two of wagons for United States government purposes in the Ordnance building;

STUDEBAKER SPRINKLER.

one of farm wagons in the Stadium; one with a general display in the Transportation building. Perhaps the most satisfactory exhibit to visitors will be that of the six vertical spray sprinklers in daily use about the grounds. Their method of operation is shown in the accompanying illustration. Some push cart sprinklers are also in use.

Trade Publications.

The Castalia Portland Cement Co. of Pittsburgh, Pa., and Castalia, O., has recently issued an illustrated booklet descriptive of their Tiger brand of cement and its method of manufacture, giving photographs of the plant in several general views and the details of the rotary kilns, slurry tanks, fuel storage and feeding apparatus. It also gives many photographs of works in which the cement has been used. The information regarding the cement is quite full and the list of testimonials is long and includes much important work.

The Peninsular Portland Cement company of Jackson, Mich., has issued a "Souvenir on the History, Development and Future of Portland Cement," which is a most handsome example of the engraver's and printer's arts. In accordance with its title it describes the development of the cement industry and gives descriptions of very many of the uses for first-class Portland cement. The statement regarding the manufacture of Peninsular Portland cement is comprehensive, and the company's warranty is definitely stated and should be fully satisfactory to intending purchasers.

A booklet "About Lockers," especially expanded metal lockers, is issued by Merritt & Co. of Philadelphia, showing the advantages of their system of hanging clothing of workmen in factories, patrons of gymnasiums, and the like.

The Industrial City company of Indiana issues a prospectus of the project and a map of the proposed location and lay out of grounds for factories and residences of

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operators. Edward B. Porter, Indianapolis, Ind.

The Paul H. White Engineering Works, Indianapolis, Ind., issues a handsome circular descriptive of their steam automobiles for heavy city traffic which makes a comparison with horse power for drays, trucks and omnibuses, in cost and convenience.

Trade Notes.

BRICK.

A. O. Jones of Zanesville, O., is interested in the proposed erection of a plant at St. Louis, Mo., for the manufacture of paving brick, according to press reports.

J. N. Olds and T. M. Robinson contemplate the erection of a plant at Granite, O. T., for the manufacture of vitrified and common brick.

The Wannamaker Clay Mfg. company, Baltimore, Md., will manufacture vitrified paving and sewer brick. The company was recently incorporated.

The Joplin Vitrified Brick company, Joplin, Mo., has been incorporated to manufacture brick, tiling and general shale product. A. D. Stevens is interested.

A. E. Lain and D. W. Ballon are reported as having secured a site at Hennessey, O. T., for establishing a vitrified brick plant.

A fire brick combination has been formed in the Portsmouth, O., district. Three plants, located at Portsmouth and South Webster, O., and Fire Brick, Ky., have joined the combine, and the plants at Ironton and Oak Hill, O., and Ashland, Ky., will enter into the agreement. The object in forming the combination is to put aside detrimental competition, fix prices, and promote economy in manufacture. The combination which will take charge of the individual plants about June 1, will be known as the Portsmouth & Kentucky Fire Brick company.

A stock company is being formed at St. Joseph, Mo., by R. McDonald and J. J. Peters for the manufacture of paving brick.

A deposit of clay has been discovered and tested near Seattle, Wash., by Julius Gobeaux of Vanassilt, Wash., who says it will make a paving brick equal to the Galesburg product. A company will be formed to develop the clay.

CEMENT.

The American Fireproofing and Cement company, Yonkers, N. Y., has been incorporated by A. F. and F. E. Seligsberg of New York City and Alphonse de Manl of Yonkers.

The Heiley Lime and Cement company of St. Louis, Mo., has purchased land on Converse-ave. and will erect a large lime and cement warehouse.

The Pacific Cement Works company has been incorporated under the laws of New Jersey by James Keith-Fisher of Victoria, B. C., and Alfred H. Mugford of New York City.

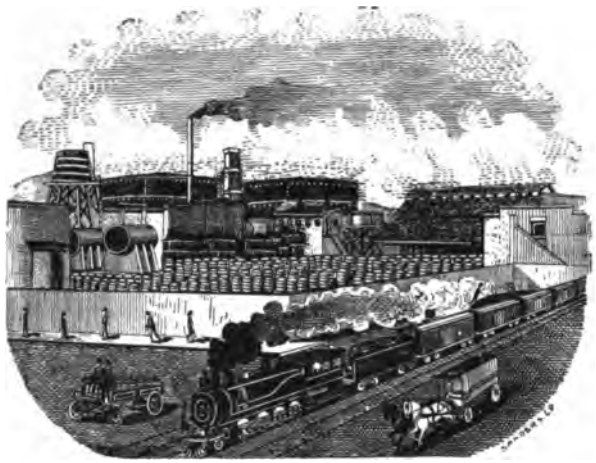
The Hecla Portland Cement company of Detroit, Mich., has been organized and incorporated under the laws of West Virginia by Cameron Currie, Julius Stroh, Edward H. Parker and H. H. Hatch of Detroit and Ubald R. Loranger of Bay City.

The Atlas Plaster company of New Jersey has been incorporated to manufacture Portland cement by Harry P. Miller of Hoboken, N. J.; Abraham L. Angle, G. Waddell et al. Willer & Lichtenstein, attorneys, Hoboken, N. J.

The Coplay Cement Manufacturing company, Allentown, Pa., has been incorporated by Clarence L. Smith, Ellwood M. Davis, D. Frank Carroll, Alphonsus Carroll, Samuel A. Etsir, Preston Stratton and Otto K. Liveright of Philadelphia.

The Indiana Portland Cement company will begin the erection of a $2,000,000 plant at Nulltown with a capacity of 600 barrels of cement per day. Vanton O. Foulke, secy.

A. Moore, formerly with the Colorado Portland Cement company, is visiting the Pacific coast in an effort to induce capitalists to erect a large Portland cement plant on the coast.



TRINIDAD ASPHALT MANUFACTURING COMPANY'S REFINING PLANT.

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LIGHT, HEAT AND POWER.

The lighting companies of Cincinnati have been consolidated under the name of the Cincinnati Gas & Electric company.

The People's Electric Light company has consolidated with the Citizens' General Electric company at Louisville, Ky.

The Union Light, Heat & Power company is a new organization formed at Covington, Ky., by the consolidation of the Covington Gas Light company and the Suburban Electric Light company.

The city council of Richmond, Ind., has granted a franchise to H. I. Yaryan of Toledo, O., for a hot water heating plant.

The Illinois Pneumatic Power company, Chicago, has been incorporated to operate power, light, heat and refrigerating plants, by W. J. Burdsall, Gust. Hallstein and Joseph Gilloley.

SEWER PIPE.

The American Sewer Pipe company, Nashville, Tenn., has been incorporated by W. D. Bates, C. H. Ewen, Eugene McSweeney, C. T. Boyd and E. L. McNeilly, to manufacture sewer and drainage pipe.

F. L. Lang of Cleveland and Card & Prosser of Lisbon, O., have purchased the Coleman sewer pipe plant and the Pitchard & Jordan brick works at Lisbon, and will organize an operating company with a capital of $100,000 and both plants will be extended.

W. C. Beem of Lehigh, Ia., and Dr. Wilson of Dayton, Ia., have formed a partnership to manufacture brick, tile and sewer pipe. Machinery for the manufacture of sewer pipe will be put in.

The Kessler Brick and Sewer Pipe company, Helena, Mont. ,is preparing to double the capacity of its plant.

W. D. Trewhitt, Hanford, Cal., has purchased thirty-three acres of land for a site for a plant for the manufacture of vitrified sewer pipe.

At the recent annual meeting of the stockholders of the American Clay Manufacturing company, at Trenton, N. J., it was decided to change its title to the American Sewer Pipe company.

At a meeting of the independent sewer pipe manufacturers in Pittsburg, May 7, it was decided to fix a scale of prices and fight the combine.

MISCELLANEOUS.

The Allis-Chalmers company has been incorporated under New Jersey laws to manufacture stationary and other engines and machinery of all kinds. The company is organized for the purpose of consolidating a number of existing concerns, among which are the E. P. Allis company of Milwaukee, the Dickinson Mfg. company, the Gates Iron Works, and Fraser & Chalmers. The incorporators are John S. Charlton, Henry S. Wardner and Stewart Lyman.

The Aetna Construction company, Wheeling, W. Va., has been incorporated to build railroads, bridges, culverts, dams and other structures. The incorporators are Henry Schmulbach, William Murray, C. W. Welty, S. M. Noyes and Geo. Baird of Wheeling.

The St. Louis Water Purifying company, St. Louis, Mo., has been incorporated by V. O. Sanders, Arnold Knock, Z. W. Tinker, H. Emanuel, W. Sommers and Arnold Knock.

Newly incorporated companies: Rome Gas, Electric Light and Power company, Rome, N. Y.; Bedford Light, Heat and Power company, Bedford, Ind.; Independent Gas company, Camden, N. J.; Paris Transit, Light and Power company, Paris, Tex.; Century Electric company, San Francisco, Cal.; Carthage Electric Light and Power company, Carthage, N. Y.

Hetherington & Berner of Indianapolis have shipped to New York City for the use there of the Warner-Quinlan Asphalt Paving company, a new style all-steel construction stationary asphalt plant, embracing many new patented features.

Newly incorporated water companies: La Salle Water Works company, La Salle, N. Y.; Corinth Water Works company, Jackson, Miss.; College Hill Water company, College Hill, Pa.; Winsboro Water Works company, Winsboro, Tex.; Beaumont Water company, Beaumont, Tex.; Benicia Water Works company, San Francisco, Cal.

The new plant of the Wilmington Railway Spring and Manufacturing company at Washington, Pa., was designed by William B. Scaife & Sons, Pittsburg, Pa., who will also manufacture and erect the buildings. They will be of steel frame construction, with slate roofs and corrugated iron sides.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Ottumwa, Ill.—This city purchased a steam road roller May 15 of the O. S. Kelly company, of Springfield, O., for $3,100, and a stone crusher of the Austin & Western company of Chicago for $975.

Sleepy Eye, Minn.—A Citizens' Improvement Association was organized May 15 with the following officers: President, I. M. Olsen; vice-president, C. D. Griffiths; secretary, Mans Mo; treasurer, C. P. Black.

Bay City, Mich.—A committee composed of City Engineer Turner, Chief Harding, Alderman Schindehette and Michael O'Malley visited Toledo, Columbus, Marion and Dayton, O., recently for the purpose of investigating pavements.

St. Paul, Minn.—A resolution was approved May 7 requiring all paving specification to provide for a ten-year guarantee, a surety company bond for the full amount of the contract and 15 per cent. of the contract to be retained.

Indianapolis, Ind—The board of public works will investigate the merits of asphalt pavement laid by the R. F. Conway company of Chicago, and if passed as satis-

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factory the asphalt specifications will be changed so as to admit that company to competition.

Philadelphia, Pa.—The councils' committee on highways decided May 13 to report favorably an ordinance which provides that the department of works shall not accept the dedication of any street or shall not place it upon the city plan unless laying of water pipes, sewer construction and paving in said street shall have come directly under the supervisor of the department.

Marion, Ind.—Judge Paulus of the circuit court overruled, May 18, the demurrer in the injunction suit filed against the proposed asphalt boulevard to the Soldiers' Home and granted a permanent injunction against such improvements. A new petition will be prepared and filed with the county commissioners asking for an election in Center township to vote on the improvement under the terms of the law passed by the last legislature.

Columbus, O.—Suit was filed in the United States courts May 18 by the Gardner Savings and Investment company of Gardner, Me., the purpose of which is to test the liability of the county for $257,000 on street improvement bonds. The supreme court held recently that the property-owners are not liable. The bonds were signed, but were not guaranteed by the county commissioners. The fact that there are similar cases in other counties in Ohio will make the result of this test suit of interest to investors.

CONTEMPLATED WORK.

Boulder, Colo.—Fourteenth-st. will be paved.

Lincoln, Neb.—Paving is proposed for a number of streets.

Quincy, Mass.—Paving is proposed on Willard and Quarry-sts.

America, N. Y.—The purchase of a stone crusher is proposed.

Sioux City, Ia.—Brick paving is contemplated for certain alleys.

Milwaukee, Wis.—A new macadam road in State Fair park is proposed.

Butte, Mont.—Granite block paving is contemplated for Park-st.

Brookville, Pa.—Brick paving is contemplated for four streets.

Augusta, Ga.—Asphalt repairing is contemplated for Broad-st.

Baraboo, Wis.—Ash-st., from the Bridge to First-st., will be paved.

Moscow, Idaho—The committee on paving will recommend Telford paving.

Fowler, Ind.—This town voted May 8 to pave more streets with brick.

Bridgeton, N. Y.—Ordinances have passed for improving six streets.

Hancock, Mich.—A committee has been appointed to purchase a stone crusher.

Lorain, O.—Macadam paving has been recommended for Eleventh and Twelfth-aves.

Wausau, Wis.—The macadamizing of Grand-ave. and Jackson-st. is contemplated.

Bowling Green, O.—An ordinance to pave Main-st. has been passed. Mayor Shatzel.

Flemington, N. M.—The sum of $20,000 has been appropriated for stone roads.

Montclair, N. J.—The town council decided May 13 to macadamize portions of ten streets.

Atchison, Kas.—Paving has been asked for on Laramie-st., from Ninth to Twelfth.

Witbee, Wis.—This town will vote on the question of building a turnpike road.

North Adams, Mass.—The council voted to issue $10,000 for paving Center-st.

Urbana, Ill.—Paving is desired for Romine-st., from Main-st. to Springfield-ave.

Goshen, Ind.—(Special)—Mayor Deahl says that six blocks of brick paving is contemplated.

Mobile, Ala.—Plans and survey are being made for paving. D. M. N. Ross, cy. engr.

Watertown, Wis.—The property owners in First and N. First-sts. have petitioned for paving.

Paterson, N. J.—Squaw Brook road will be macadamized soon at an estimated cost of $10,000.

Aurora, Ind.—(Special.)—The city clerk says that a cement sidewalk may be built on one street.

Hartford City, Ind.—City Engineer Harley favors brick for repaving the principal streets.

Chattanooga, Tenn.—The improvement of Oak-st., between Douglas and Baldwin, is contemplated.

Albany N. Y.—Asphalt is proposed for resurfacing S. Pearl-st., from State to Ganse-voort-st.

Columbus, O.—Washington-st., between Broad and Town-sts., will be resurfaced with asphalt.

Homestead, Pa.—Brick paving is proposed for about two miles of alleys. Wm. A. P. Wilson, cy. engr.

Savannah, Ga.—The city council has dedecided to pave Gaston-st. with vitrified brick. Mayor Myers.

Decatur, Ind.—The question of building macadam roads in Jefferson twp. will be voted on June 15.

Chicago, Ill.—An ordinance creating the new South Side boulevarding system has been passed.

Jacksonville, Ill.—Brick paving on concrete base is contemplated for S. East-st. and Hardin-ave.

Sheboygan, Wis.—About 10,500 sq. yds. of macadam paving is contemplated. C. N. Boley, cy. engr.

Oklahoma City, Ok. T.—A petition is being circulated by Chas. Colard and others for asphalt paving.

Adrian, Minn.—Stone or cement sidewalks have been ordered constructed in the business district.

Leavenworth, Kans.—A resolution has been passed to pave Fourth-st., from Spruce to Pine, with brick.

Springfield, Mo.—A number of resolutions have been passed of intention to improve certain streets.

Middletown, N. Y.—This town voted, May 9, to appropriate $3,000 for the purchase of a steam road roller.

Minneapolis, Minn.—The city council has ordered University-ave., S. E., paved with sandstone on concrete.

Kewanee, Ill.—Brick paving is contemplated for five blocks of Tremont, Prospect and Division-sts.

Macon, Ga.—The citizens on Mulberry-st., between Spring and Second, have petitioned for brick paving.

South St. Paul, Minn.—The South St. Paul Stock Yards company will expend $30,000 to

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$40,000 in paving the streets through the yards.

Flint, Mich.—The construction of ¾-mi. of paving, probably tar macadam, is proposed. A. W. Hall, cy. engr.

Toronto, Ont.—The estimated cost of macadam paving on George-st. is $141,940 and Brooklyn-ave. $4,445.

Sparta, Wis.—(Special.)—H. Blyton, cy. clk., says that macadam paving on granite foundation is contemplated.

Quincy, Ill.—The property owners on Vermont-st. are inclined to favor tar macadam paving for that street.

Marion, Ind.—Brick paving is proposed for Second-st., from Butler to Geneva-aves. C. G. Robbins, cy. clk.

Baltimore, Md.—Mayor Hayes has signed the ordinance to pave Bayard-st., from Columbia-ave. to Herkimer-st.

Des Moines, Ia.—The property owners in Park Lane want that street paved from Grand-ave. to Greenwood Park.

Youngstown, O.—Resolutions are pending providing for the repaving of Market-st., Wick-ave. and Central Square.

Randolph, Vt.—This village has voted to macadamize the two principal streets at an estimated cost of $3,000.

Wilmington, Del.—Brick paving has been ordered on eleven, Belgian blocks on six and macadam on three streets.

Denver, Co.—The property owners in Fourteenth-st., from Detroit-st. east, have petitioned for asphalt paving.

Duluth, Minn.—The question of brick paving is being investigated by a committee of council and board of public works.

Ludington, Mich.—The construction of macadam paving at a cost of $45,000 is contemplated. J. Edwin Smith, cy. clk.

Clinton, Ia.—Special.—The city council condemned about 10 mls. of old walks May 14, and will replace with cement walks.

Boone, Ia.—Resolutions have been passed for paving Allen and Seventh-sts with brick on concrete. Jesse L. Hull, cy. clk.

Fowler, Ind.—About 18 mls. of gravel road will be built in Benton county, making a total of 168 mls. of good roads.

La Grange, Ill.—Plans are being made which will provide that all walks shall be constructed of cement or cut stone.

Thousand Island Park, N. Y.—A boulevard will be built from this place to Westminster Park, a distance of 6 mls.

San Jose, Cal.—The question of issuing bonds for streets, sewers, an electric light plant, etc., will be voted on June 6.

San Francisco, Cal.—City Engineer Grunsky has recommended the repaving of Market-st., from Van Ness-ave. to Valencia-st.

Delmar, N. Y.—Plans have been approved for a macadam road, 1¾ mls. long, between this place and Slingerlands.

Lyon, Mass.—The question of issuing $240,000 bonds for street improvements is being considered by the board of aldermen.

Farmington, Minn.—(Special)—C. I. Wells, cy. rec., says that several blocks of cement walks will be constructed this summer.

Clinton, Ind.—The property-owners on Fifth-st., from Sycamore to Nebeker, have petitioned for concrete sidewalks.

Bloomington, Ill.—About 17,500 sq. yds. of brick paving will be constructed at a cost of $22,000. Elmer Folsom, cy. engr.

Muskegon, Mich.—Vitrified brick, macadam and aspnalt block paving is proposed to replace the cedar block paving in this city.

Anaconda, Mont.—Paving, curbing and the placing of new catchbasins in E. Park-st., between Arizona and Covert-sts., is contemplated.

Madison, Wis.—The question of paving the streets around the capitol park with asphalt is again being considered. Mayor Ball.

New Brunswick, N. J.—(Special)—Asher Atkinson, cy. engr., says that $15,000 will be expended on brick and $3,200 on block paving.

Depew, N. Y.—Engineer Wings has been directed to prepare plans and specifications for macadamizing a number of village streets.

Independence, Mo.—A resolution has been passed to pave two streets with brick with artificial stone curb. W. H. Pendleton, cy. engr.

Indianapolis, Ind.—A resolution has been adopted for resurfacing Illinois-st., from Ohio-st. to Jackson-place, with asphalt.

State Center, Ia.—(Special)—W. J. Whitehill, cy. clk., says that this city contemplates paving three blocks of the main street with brick.

Mason City, Ia.—The question of additional paving is being considered. The residents on Washington-ave, have petitioned for asphalt.

Iowa City, Ia.—A resolution has been adopted providing for 17,200 sq. yds. of brick paving on concrete base. Chas. S. Magowan, cy. engr.

Davenport, Ia.—Grading, paving and curbing is contemplated for Second and Third-aves. at a cost of $1,887 and $1,857 respectively.

Springfield, Ill.—Arthur Hay, secy. and engr. of the park board, is setting stakes for the proposed boulevard, which will be macadamized.

Helena, Mont.—A vitrified brick sidewalk will be constructed in front of the Auditorium and the library building. Bids will be asked at once.

St. Joseph, Mo.—Petitions are being circulated for paving S. Fourth-st., from Seneca to Renick, and Mitchell-ave., from Fourth to Sixth.

Kansas City, Mo.—The ordinance to repair the asphalt pavements of down-town streets was passed over the mayor's veto, May 13.

Niagara Falls, N. Y.—Estimates have been submitted for the proposed asphalt, brick or macadam paving on Cedar-ave. and Seventh-st. Cy. Engr. E. D. Very.

De Kalb, Ill.—(Special)—The construction of five miles of brick paving is contemplated this summer. Contracts will be let within a month. W. M. Hay, cy. engr.

Denver, Colo.—The city engineer has been directed to prepare plans and specifications for paving Logan-ave., from Colfax to Eighteenth-aves., with macadam.

Toledo, O.—A resolution has been adopted to invite brick manufacturers to send a carload of brick, to be laid on Superior-st., for the purpose of testing.

Great Falls, Mont.—Mayor Collins in his annual message recommends favorable ac-

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tion on petitions now pending for boulevarding additional streets and avenues.

Cincinnati, O.—The estimated cost of improving Carthage pike from Mitchell-ave. to the Gas Hall in Carthage, with granite, is $427,932. Frank Krug, co. engr.

Seattle, Wash.—The street committee reported favorably May 17 on the ordinance to pave Summit-ave. from Broadway to Spring and two intersecting blocks, with asphalt.

Macomb, Ill., (Special)—Cephas Holmes, cy. engr., says that bids will probably be asked about June 7 for 24,000 sq. yds. of double course brick paving on sand foundation.

Marion, Ia.—A resolution has been passed to pave Eighth-st., between Twelfth and Twenty-second, with asphalt, and Seventh-ave., between Thirteenth and Nineteenth, with macadam.

Freeport, Ill.—Brick paving is contemplated for Stephenson and Galena-sts. A petition has been submitted to the village board of West Freeport asking for brick paving on Bailey-ave.

Indianapolis, Ind.—Residents on Meridian-st., north of Fall Creek, are divided on the question of material for that thoroughfare. Both asphalt and creosoted wooden blocks are advocated.

Minneapolis, Minn.—Paving has been recommended as follows: Sixth-st., N. Hennepin to Third-ave., brick; Tenth and Eighth-sts., cedar block; Washington-ave., north, sandstone; Marshall-st., ne., macadam.

New Orleans, La.—Asphalt paving will be constructed soon as follows: Canal-st., 116,000 sq. yds.; Jefferson-st., 800 sq. yds.; Brooklyn-st., two sections, 10,400 and 5,440 sq. yds. respectively; Powder-st., 2,500 sq. yds.

Mansfield, O.—The estimated cost of proposed improvements is as follows: Paving E. Fourth-st. with brick block, $11,290; sheet asphalt, $17,250; block asphalt, $21,150; paving Orchard-st., $6,033, Jacob Laird, cy. engr.

Frankfort, Ind.—(Special.)—Charles E. Chaney, cy. engr., says that street paving is contemplated as follows: Two thousand five hundred feet of asphalt on concrete; 2,200 ft. of brick; 1,500 ft. of gravel with stone curb, brick sidewalk and gutter.

Marinette, Wis.—The council has decided to pave Main-st., from the tracks to Stanton-st., with brick, macadamize Stephenson-st., from Hall-ave. to Pierce-ave., with stone curbing, macadamize Ludington and Wells-sts.

Englewood, Ill.—The property owners on Normal-ave. and near by streets are making efforts to secure asphalt paving. D. B. Jesse, C. D. Church, P. J. O'Connell, M. J. Holding and W. H. Wells compose the committee on street improvements.

Columbus, Ga.—Robert L. Johnson, supt. pub. wks., says that council has passed favorably upon a petition of abutting property owners to have Twelfth-st., from First-ave. to the Union depot, 12,600 sq. yds., paved with vitrified brick.

Sioux Falls, S. D.—The property owners in Duluth-ave. desire brick or other paving. The bids secured for cement walks were rejected. The city has been divided into three districts and bids will be taken by the district.

Council Bluffs, Ia.—A final hearing will be given June 3 on the resolutions to pave parts of Tenth, Fairview, Park, Third and Fourth-aves., and Third, Worth and Vine-sts. with brick. Victor Jennings, mayor; N. C. Phillips, cy. clk.

Paris, Ill.—(Special.)—W. C. Lemon, cy. engr., says that about 11,050 sq. yds. of brick paving on 6 in. concrete base, with limestone curb and combined concrete curb and gutter is contemplated, and that bids will probably be asked the latter part of June.

Houston, Tex.—(Special.)—Wm. Bradburn, co. surveyor, says that the commissioners' court will advertise for bids for gravel, shell and macadam roads. The specifications were prepared by Wm. Bradburn, who will furnish them, on application, to all responsible contractors.

Binghamton, N. Y.—The city engineer was instructed May 14 to prepare plans for paving Oak-st., betweeen Main and Riverside Drive, with vitrified brick. Specifications for 10,000 sq. yds. of paving on Oak, 2,742 sq. yds. on State and 2,258 sq. yds. on Susquehanna-sts. were adopted.

Grand Rapids, Mich.—Estimates of the cost of street improvements have been submitted as follows: N. College-ave., from Lyon to E. Fulton, asphalt $12,388; macadam, $6,464; S. Fuller-st, from Wealthy-ave. to Sherman-st., gravel, $6,631; Madison-ave., from Fifth-ave. to Hall-st., asphalt blocks, $26,080; Ottawa-st., from Pearl to Lyon, asphalt, $3,134.

Chicago, Ill.—Ordinances for stone paving have been recommended for passage as follows: Asphalt—State-st., from Twenty-sixth to Thirty-ninth, $80,000; e. s. Cottage Grove-ave., from Drexel Square to Fifty-ninth-st., $32,000; Larrabee-st., from Clybourne-ave., to North-ave., $11,500. Granite—Canal-st., from Harrison to Lumber, $55,000; Halsted-st., from Division-st. to Chicago-ave., $17,000.

Kalamazoo, Mich.—Alderman M. Westbrook has recommended resolutions for paving, involving the following: E. South-st., from Rose to Portage, brick, asphalt, block or macadam; Eleanor-st., from Burdick to Rose, brick; W. Lovell, from West to Davis, macadam; Edwards, from Main to Kalamazoo-ave, brick; Kalamazoo-ave, from Edwards to Burdick, brick; Academy, from Rose to West, tar macadam.

CONTRACTS TO BE LET.

Bay City, Mich.—Bids are asked until June 4 for 3,000 sq. yards of brick paving. Geo. Turner, cy. engr.

St. Paul, Minn.—Bids are asked until June 3 for grading the upper Afton road. W. R. Johnson, co. audt.

Cleveland, O.—Bids are asked until June 13 for asphalt paving in Euclid-ave. C. P. Sales, dir. pub. wks.

Cincinnati, O.—Sealed bids are asked until June 8 for improving North Bend and Cliff roads. Eugene L. Lewis, co. audt.

Michigan City, Ind.—Sealed bids are asked until June 10 for 5,400 sq. yards of cement sidewalks. H. M. Miles, cy. engr.

Des Moines, Ia.—Bids are asked until June 10 for 10,000-cu. yds. of grading on Summit-st. G. A. Eberhart, chmn. B. P. W.

Fort Hamilton, N. Y.—Bids are asked

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until June 11 for constructing roads on the U. S. reservation. Brooke Payne, Q. M.

Kentland, Ind.—Sealed bids are asked until June 3 for building a free macadam road in Jefferson twp. Schuyler C. Jones, co. audt.

Shreveport, La.—Sealed bids are asked until June 6 for asphalt brick and granite paving in a number of streets. N. B. Murff, compt.

Rensselaer, Ind.—Sealed bids are asked until June 3 for constructing the De Motte and Otis gravel roads. Wm. C. Babcock, co. audt.

Valparaiso, Ind.—Sealed bids are asked until June 8 for building certain roads in Union and Portage twps. John Bornholt, chmn. co. com'rs.

Toledo, O.—Bids are asked until June 24 for repaving with vitrified block or asphalt paving on Maumee-ave. J. E. Connell, cy. clk.

Ashland, O.—Bids are asked until June 3 for macadamizing 4-mls. of road in Montgomery twp. Chas. W. Garver, clk. bd. twp. trustees.

Vincennes, Ind.—Sealed bids are asked until June 4 for building about 14-mls. of gravel roads in Busseron twp. J. D. Williams, co. audt.

Rushville, Ind.—Sealed bids are asked until June 4 for paving an alley with brick. John Rutlidge, cy clk. Wm. Dill, cy. engr.

Crawfordsville, Ind.—Sealed bids are asked until June 3 for building cement walks on Mill and Marshall-sts. E. S. Simpson, cy. engr.

Glens Falls, N. Y.—Sealed bids are asked until June 17 for 9,000 sq. yds. of granite block paving on concrete base. Geo. P. Slade, vil. engr.

Bowling Green, O.—Bids are asked until June 12 for building a cement sidewalk eight feet wide on Fourth-st. side of the court house grounds. C. Weaver, co. audt.

Millvale, Pa.—Bids are asked until June 4 for paving Sedgewick-st., from Fremont to Farragut, with brick. C. W. Dankmeyer, clk.; Edw. B. W. Pfischner, burgess.

Lima, O.—Bids are asked until June 7 for 13,303 sq. yds. of brick and 2,150 sq. yds. of asphalt block paving on a number of streets. C. E. Lynch, cy. clk.

Springfield, Mass.—Bids are asked until June 1 for laying tar, concrete and cement sidewalks. Bids are also asked until June 1 for two 10-ton steam road rollers. Supt. Adams.

Lima, O.—Bids are asked until June 7 for paving requiring the following: Brick, 13,302 sq. yds.; asphalt, 8,000 sq. yds.; asphalt block, 21,500 sq. yds. C. E. Lynch, cy. clk.

Springfield, O.—Sealed bids are asked until June 13 for grading and graveling sidewalks, artificial stone and limestone curb and gutters, etc. R. W. Lantz, cy. clk.

Dayton, O.—Sealed bids are asked until June 4 for grading and graveling the sidewalks and roadways of Haynes-st. and paving an alley with boulders. G. F. Kuhns, prest. B. C. A.

Lagrange, Ill.—Sealed bids are asked until June 1 for 133,000 sq. yds. of cement sidewalk. Bd. local imp., Wm. S. Ewing, engr., 1003 Chamber of Commerce Bldg., Chicago.

South Bend, Ind.—Sealed bids are asked until June 11 for building cement walks and curbs on Francis street; cement curbs and brick paving on N. Michigan-st. Arthur L. Hubbard, chm. B. P. W.

Des Moines, Ia.—Sealed bids are asked until June 8 for 8,398 sq. yds. of brick paving on W. Eighth-st. and 5,300 lin. ft. of Portland cement curb on Washington-ave. G. A. Eberhart, chm. B. P. W.

Wheeling, W. Va.—Bids are asked until June 5 for furnishing paving brick, sewer pipe and curbing during 1901; also for dressing and resetting old curbing. Wm. H. Paul, clk. B. P. W.

New York City—Bids are asked until June 4 for paving three streets in Manhattan with asphalt on concrete; one street in Bronx with granite blocks on sand foundation. James P. Keating, comr. of highways.

Bedford, Ind.—Sealed bids are asked until June 11 for building gravel and macadam roads in Bono township as follows: Mitchell and Bono road, 4,577 feet; Lawrence port and Fishing Creek Chapel road, 10,410 feet. John M. Gainey, co. audt.

Albia, Ia.—Sealed bids are asked until June 6 for paving Benton, Clinton, Main, Washington, Jefferson and Harrison-sts. with brick, requiring 13,792 sq. yds. of paving and 6,650 feet of stone curb. W. K. Hardenbrook, mayor; T. J. Baird, cy. clk.

Cincinnati, O.—Sealed bids are asked until June 7 for brick paving for a stable to be erected in N. S. of George-st., west of Central-ave., for the city water works department. Sealed bids are asked until June 12 for paving Pennwork alley with brick. Robert Allison, prest. B. P. W.

Janesville, Wis.—Sealed bids are asked until June 8 for improving portions of seven streets with macadam, requiring the following: 5,275 cu. yds. excavation; 17,849 sq. yds. macadam pavement; 3,847 lin. ft. combined cement curb and gutter; 4,009 ft. cement curbing; 535 ft. of stone curbing. C. V. Kerch, cy. engr.

New York City.—Bids are asked until June 6 for repaving with rock asphalt mastice, walks in Riverside Park, from 72d to 79th-sts., and from 96th to 120-sts. Bids are asked until June 6 for furnishing and delivering Marcellus shale sandstone screenings where required in the Ocean and Eastern Parkway, Bor. of Brooklyn. Geo. C. Clausen, com'r. of Parks, N. Y. City.

La Crosse, Wis.—Sealed bids are asked until June 3 for 27,123 sq. yds. of macadam paving, 15,847 lin. ft. of combined cement curb and gutter and 4,986 cu. yds. of graveling. Bids are asked until June 4 for 7,635 lin. ft. of combined cement curb and gutter and 1,530 cu. yds. of graveling. Bids are asked until June 5 for 4,580 sq. yds. of macadam paving and 1,040 cu. yds. of grading. Henry J. Beckweth, chmn. B. P. W.

Wapakoneta, O.—Sealed bids are asked until June 14 for paving Blackhoof-st., from Auglaize-st. to the Toledo & Ohio Central R. R. with brick or blocks, requiring the following: 5,614 cu. yds. of exc.; 2,622 ft. of 6, 8, 10, 12, 15, 18 and 24-in. sewer pipe; 9 T's 6x12; one T 10x12; 8 T's 6x15; one Y 10x12; 4 Y's 10x15; 6 10-in. curves; 17 stoppers 6-in.; one stopper 15-in.; 3 manholes complete; one manhole cover to adjust; 6 Duplex inlets, No. 4; one straight curb

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catch basin; 4 corner catch basins; 23 cast gutter crossing plates 2x5 ft.; 4,052 ft. straight curb 5x18; 354 ft. circular curb 4x15; 8,558 sq. yds. brick paving, 15-perch retaining wall. Chas. E. Fisher, vil. clk.; Samuel Craig, engr.

St. Louis, Mo.—Sealed bids are asked until June 4 for furnishing and delivering macadam and macadam screenings and screened gravel; repairing old sidewalks with brick; constructing and reconstructing sidewalks with artificial stone flagging; repairing alleys with limestone, granitoid, vitrified brick or granite; repairing gutters, alley entrances and curbs with limestone; repairing granitoid curbs and gutters and alley entrances with brick or granitoid. H. Phillips, prest. B. P. W.

CONTRACTS AWARDED.

Oskaloosa, Ia.—The contract for cement walks was awarded to Ed Mathews and Geo. Carlon & Son.

Greensburg, Pa.—The contract for $25,000 worth of street paving has been awarded to R. T. Hallman & Son.

St. Paul, Minn.—The contract for paving Sibley-st., with brick, was awarded to Fielding & Sheply for $17,672.

Springfield, O.—The contract for paving Clifton-st., with brick, was awarded to Edward Ryan, at $1.42 a sq. yd.

Lima, O.—The contract for paving Buckeye and Cherry alleys was awarded to Spyker, Mulligan & O'Brien, May 13. Logan block will be used.

Chicago, Ill.—The R. F. Conway company was awarded the contract for curbing, grading and paving with vitrified brick on old macadam, Forty-seventh-st.

Greensburg, Ind.—The contract for building nine miles of free pike in Marion twp., was awarded May 18, to A. L. Donaldson, of Bloomington, for $17,240.

Watertown, N. Y.—The Barber Asphalt Paving company secured the contract, May 17, for paving Washington-st., at $1.99 a sq. yr. or $17,634.75.

Ridgewood, N. J.—The contract for macadamizing Spring and Woodside-aves. has been awarded to Wm. C. Munro of this place, at 48 cents a lin. ft.

Jamaica, (L. I.) N. Y.—The contract for opening, macadamizing, guttering and curbing four streets has been awarded to the Eastern Stone company, for $30,000.

Bristol, Va.—The contract for paving Main-st. with brick was awarded May 1, to the Portsmouth Paving company, of Portsmouth, O., at $1.68 a sq. yd.

Hackettstown, N. J.—Salmon Bros. of Ledgewood secured the contract for building 28,750 ft. of macadam road between this place and Allamuchy for $21,024.

Tampa, Fla.—Paving contracts have been awarded as follows: Brick paving, H. H. Scarlett of this city, $1.65 a sq. yd.; macadam, W. H. Kendrick, 90 cents a sq. yd.

Birmingham, Ala.—Dunn & Lallande Bros. was awarded the contract for grading, macadamizing, curbing and paving brick gutters in numerous streets, for $27,485.

Wilmington, Del.—The contract for paving Lombard-st. with granite blocks, from Eleventh to Thirteenth, was awarded to Simmons & Bros., at $1.55 a sq. yd.

Eau Claire, Wis.—The contract for brick paving was awarded to A. E. Ruttledge & Co., at $1.36 a sq. yd., and for macadam paving to J. W. McCann at 56 cents a sq. yd.

Cohoes, N. Y.—The Albany Construction company was awarded the contracts May 15 for paving Broadway-st. and Johnston and Younglove-aves with Catskill brick, at $2.17 a sq. yd.

Utica, N. Y.—The Barber Asphalt Paving company was awarded contracts May 17 for asphalt paving as follows: Roberts-st., $4,704.60. Avery plan, $4,778.50; State-st., $10,572.60.

Salt Lake City, Utah—The contract for paving the north sidewalk on Brigham-st., from State to B, with stone, was awarded to Simpson & Tyne, at $1.25 a lin. ft., and $6.00 each for cornerstones.

South Bend, Ind.—The contract for paving W. Navarre-st. with brick was awarded to Robert Hoban & Roach of this city at $1.33 a sq. yd. for Athens block; total, including grading and excavating, $7,322.

New Albany, Ind.—Contracts have been awarded to the Barber Asphalt Paving company as follows: 3,700 sq. yds. of asphalt on macadam base, $1.40 a sq. yd.; 3,400 sq. yds. of asphalt on 6-in. concrete base, $1.92.

Brooklyn, N. Y.—Thos. F. Byrnes has been awarded the contract for paving McKibben-st. with trap block on sand foundation, for $14,428. The contract for paving Park with granite block on sand foundation will be readvertised.

Fort Dodge, Ia.—The Likes Improvement company of Des Moines, was awarded the contract May 14 for constructing all of the paving that will be done in this city this summer, as follows: Brick paving on streets, $1.19 a sq. yd.; alleys, $1.29.

Grand Rapids, Mich.—Contracts were awarded May 14 as follows: Paving Broadway, from W. Bridge to Seventh-sts., with brick, Albert Prange, $12,923; grading and graveling Ridge-ave., from S. Division to Buchanan, Gilner & Mueller, $4,900.

Columbia City, Ind.—The contract for 20,165 sq. yds. of brick paving on Van Buren, 13,685 sq. yds. in Line, and 11,713 sq. yds. in Chauncey-sts., was awarded to Frank Brumbaugh of Elkhart, Ind., at $1.23 a sq. yd.; total, $66,740.

Norwich, N. Y.—The Park Paving company of Rochester, Pa., was awarded contracts as follows: Broad-st., $19,368; W. Main-st., $3,121; American-ave., $946; Callman Road Improvement company—Silver-st., $10,016; N. Broad-st., $2,366; S. Broad-st., $12,025.

Louisville, Ky.—The committee on contracts has reported favorably on the following asphalt paving contracts: Second-st., from Magnolia to Burnett-ave., the Porka company; Jefferson-st., from Fifth to Seventh, Fifth from Jefferson to Market, and Sixth from Jefferson to Main, Barber Asphalt Paving company.

Knoxville, Tenn.—The contract for paving the roadway and building a sidewalk on Prince-st., between Clinch and Union-aves., was awarded May 20 to Geo. Chandler, as follows: Laying 515 sq. yds. Portland cement walk, $1 a sq. yd.; relaying 440 sq. yds. paving brick, $1; laying 70 sq. yds. new brick paving, $1.90; total, $2,285.

Buffalo, N. Y.—The Inter-State Paving

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Co. of Utica was awarded contracts May 17 for paving with Alcatraz asphalt, as follows: Repaving Ohio-st., between Dead Creek and Michigan-st., $141,000; repaving Hamilton-st., Niagara and Gorton, $52,000; repaving Clinton-st., Fillmore-ave., and Lewis-st., $5,290; paving Goodell-st., Michigan and Cherry-sts., $41,000; paving East-st., Parish-st. and Hertel-ave., $14,600.

Altoona, Pa.—(Special)—Harvey Linton, cy. engr., says contracts were awarded May 17 to Wm. H. Herr, as follows: Macadamizing Fourth-st., between Fifth and Sixth-aves., 260 ft; and Twenty-fifth-st., from Broad to Chestnut-aves., 265 ft., $1.10 a sq. yd., including brick gutters; Chestnut-ave., between Fourth and Seventh-sts., 1,070 ft., $1.18, including brick gutters.

Albany, N. Y.—Bids were received May 6 for resurfacing Watervliet-ave., as follows: Inter-State Paving Co., $1.43 a sq. yd.; Barber Asphalt Paving Co., $1.89; Warner & Quinlan, $1.25. The contract was awarded to Warner & Quinlan, for $8,612.50. Mulderry Bros. secured the contract for paving Bradford-st. with brick for $9,566.70, and Robert A. Dumary, Partridge-st. with brick for $6,193.50.

Newark, N. J.—(Special)—Ernest Adam, engr. of street and sewer department, says that the Barber Asphalt Paving Co. was awarded contracts May 16 for repaving Mt. Prospect-ave., from Sixth to Seventh-aves., Summer-ave., Warren-place, Halleck and Garrside-sts., Chester-ave., and Gillette-place with Bermudez lake asphalt at $1.92 a sq. yd. The Newark Paving Co. was awarded the contract for paving Mt. Prospect-ave., from Abington to Elwood-ave., with Mack repressed block at $2.34 a sq. yd. J. Roosevelt Shanley was awarded contracts for oblong granite block paving on State, Nassau, Lemon and Charlton-sts., and Chester-ave., from Peabody-place to Riverside-ave., at $1.74 a sq. yd.

Minneapolis, Minn.—Contracts were awarded May 6 for building gravel and macadam roads in Hennepin county, as follows: Macadam road, half mile, broken stone, $1.90 a cu. yd.; gravel, half mile, broken stone, $1.85; gravel, 65 cts.; let to Jos. Gleason; gravel roads, two miles, 70 cts. a cu. yd., L. A. Smith; 1½ miles, 87 cts., Geo. Turnham; 1½ miles, $1.07, Jerry Keys; half mile, 75 cts., Geo. Turnham; half mile, 71 cts., E. C. Evans; one mile, 65 cts., L. A. Smith.

Gloversville, N. Y.—Bids were received May 6 for brick and asphalt block paving as follows: Callanan Road Impvt. company, Albany brick, 7,000 sq. yds., $1.985 a sq. yd.; setting 3,000 ft. curb, 32 cents; concrete, 10 cu. yds., $3.75; total,, $14,593. A. M. Banker, Gloversville brick, $2.09; curb, 30 cents; concrete, $4,80; total, $15,578. Stone & Shurston, New York City, brick, $2.17; curb, 30 cents; concrete, $4.50; totals, $16,135. Frank Pidgem, Saugerties, brick, $2.31; curbing, 29 cents; concrete, $4.00; total, $17,080. Baker & Judson, Gloversville, brick, $2.39; curb, 30 cents; concrete, $4; total, $17,700. The bids for asphalt block were: Hastings Paving company, asphalt block, 3,800 sq. yds., $2.50; curb, 2,000 ft., 30 cents; concrete, 10 cu. yds., $4; total, $10,140. Abbott-Gamble Const. company, New York City, asphalt block, $2.69; curb, 35 cents; concrete, $4; total, $10,692.

New York City—The Hastings Pavement company has been awarded the contract for 11,000 sq. yds. of asphalt block paving in the West End at $2.50 a sq. yd., and 1,690 cu. yds. of concrete at $5.98 a cu. yd.; 2,780 sq. yds. of asphalt block paving in W. Fifty-sixth-st. at $2.40, and 529 cu. yds. of concrete at $6.48. The John P. Hart company was awarded the contract for grading Audubon-ave. as follows: 35 cts. per cu. yd. for 8,500 yds. earth excavation; $1.25 per cu. yd. for 35,400 yds. of rock excavation; $1.50 per cu. yd. for 1,150 yds. dry rubble masonry; 30 cts. per lin. ft. for 720 ft. guard rail; 85 cts. per lin. ft. for 8,361 ft. new curb; and 22 cts. per sq. ft. for 36,000 ft. new flagstone; amount, $64,193.

Indianapolis, Ind.—Contracts have been awarded during May as follows: Paving Louisiana-st., from Illinois-st. to Capitol-ave., with asphalt, Barber Asphalt Paving company, $3.60 a lineal ft. on each side; Illinois-st., north of Fall creek, and Ohio-st., from Noble-st. to Arsenal-ave., creosoted wooden blocks. Hoosier Construction company, $4.07 and $5,22 a lin. ft., respectively. Contracts for cement walks have been awarded as follows: Rogers & Dunlop, Belmont-ave., $1.25 a lin. ft.; Irving-place, $1.10. W. H. Abbott & Son, Neal-ave., $1.70; South-st., 81 cents; Lee-st., 58⅓ cts. Henry Maag, Dorman-st., 74 cts. A. D. Bowen, Noble-st., 54⅝ cts. for 5-ft. and 33¼ cts. for 3-ft. walks; South-st., $1.11⅓; Washington-st., $2.39; West-st., 79⅝ cts. for 7-ft. and 32 29-30 cts. for 3-ft. walks. J. C. Veney, Eleventh-st., 58¾ cts. for 5-ft. and 33¼ cts. for 3-ft. walks.

SEWERS.

CONTEMPLATED WORK.

Batavia, N. Y.—Sewer construction is proposed.

Hyde Park, Vt.—A sewerage system is contemplated.

Guthrie, O. T.—This town voted to build a sewerage system.

Moorestown, N. J.—Bids will be asked for a new sewerage system.

Fowler, Ind.—This town voted to build a sewerage system this summer.

Eagle's Mere, Pa.—An ordinance has been adopted for a sewerage system.

North Adams, Mass.—The city council voted to borrow $10,000 for sewers.

Madison, N. J.—The improvement of the sewers is proposed at a cost of $70,000.

Marysville, Kas.—Contracts will probably be let soon for a sewerage system.

Goshen, Ind.—(Special.)—Mayor Deahl says that one block of trunk sewer will be built.

Janesville, Wis.—The question of building sewers is being considered. Cy. Engr. Kerch.

Salem, Mass.—New sewers will be built at a cost of $40,000. F. L. Evans, cy. solicitor.

Salem, Wash.—An ordinance has been passed to expend $40,000 for a sewer in North Salem.

Villisca, Ia.—The question of building a sewerage system is being discussed. Mayor Gibbs.

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Fall River, Mass.—The construction of sewers in several streets has been authorized.

Tullahoma, Tenn.—The question of issuing bonds for a sewerage system will be voted on June 6.

St. Joseph, Mo.—An ordinance was introduced May 16 providing for the construction of a main sewer.

Revere, Mass.—The construction of sewers is contemplated in several streets at a cost of $7,300.

Randolph, Me.—The construction of a 24-in. pipe sewer is contemplated. B. A. Cox, chmn. com.

Iona, Minn.—(Special.)—J. J. Griffin, recorder, says that a sewerage system will be constructed.

Eldorado, Kas.—Plans for a sewerage system are being prepared by Burns & McDonnell of Kansas City, Mo.

Philadelphia, Pa.—Plans were approved May 18 for the extension of the sewerage system of this city.

Cape Charles, Va.—The town council has been authorized to issue $10,000 bonds for a sewerage system.

Eureka, Kas.—Plans are being prepared by Burns & McDonnell of Kansas City, Mo., for a sewerage system.

Canton, O.—Plans are being made for more than 8-mis. of sewers in District No. 1. Phil. H. Weber, cy. engr.

Oshkosh, Wis.—A bond issue of $17,000 is proposed for constructing sewers on Nineteenth, Main and Murdock-sts.

Sparta, Wis.—(Special.)—Wm. H. Blyton says that the construction of trunk and lateral sewers is contemplated.

Harrisburg, Pa.—A resolution has been introduced authorizing the sewering of Paxton Creek at a cost of $525,000.

Scranton, Pa.—Contracts will probably be let in July for constructing sewers in the Nineteenth sewer district.

Rossland, B. C.—A sewage disposal system at a cost of $23,000 is reported. Wm. F. Van Buskirk, cy. engr.

Watkins, N. Y.—This village voted May 17th to issue $20,000 bonds for extending the sewerage and water works system.

Omaha, Neb.—Andrew Rosewater, cy. engr., is preparing plans for a system of drainage for the south part of town.

Huntington, Ind.—The construction of sewers on Clark, W. State and Market-sts. has been authorized. Mayor Z. T. Dungan.

Bloomington, Ill.—The construction of 5,000 ft. of 12 to 10 in. pipe sewers is contemplated. Elmer Folsom, cy. engr.

Springfield, O.—The city engineer has been directed to prepare plans for sewers estimated to cost from $70,000 to $150,000.

Redwood Falls, Minn.—The city council voted May 9th to ask for bids for ten blocks of extension to the sewerage system.

Lockport, N. Y.—An ordinance has been adopted providing for the construction of Eighteen Mile Creek into a big trunk sewer.

Sheborygan, Wis.—Plans are being prepared for 2,500 ft. of brick sewers and 2,800 ft. of pipe sewers. C. N. Boleay, cy. engr.

Bristol, Pa.—The Pennsylvania Sewer company has asked the borough council for permission to construct a sewerage system.

Hillsboro, N. D.—(Special.)—A sewerage system will be constructed under the supervision of Samuel F. Crabbe, city engineer of Fargo.

Glenville, O.—The village council is considering an ordinance for the extension of the sewerage system; estimated cost $16,000.

Spokane, Wash.—Plans have been prepared for a sewerage system for the district bounded by Monroe-st and the Great Northern railway.

Akron, O.—John W. Payne, cy. engr., will begin plans at once for sewerage from North Hill and the valley north of the Little Cuyahoga.

Homestead, Pa.—About 1,500 feet of 18-inch pipe sewers, with manholes and catchbasins, will be constructed this summer. Wm. A. P. Wilson, cy, engr.

Wolfville, N. S.—Surveys and plans for a sewerage system will be made by F. W. W. Doane of Halifax. Frank A. Dixon, town clerk.

Paris, Ill.—(Special.)—W. C. Lemen, cy. engr., says that about 3,000 feet of 12, 10 and 8-inch lateral sewer extensions will probably be constructed.

Lewes, Del.—Plans and specifications for a sewerage, water works system, etc., are being prepared by T. Chalkley Hatton of Wilmington, Del.

Cicero, Ill.—The drainage trustees contemplate building a sewer from this village to connect with the Oak park, Clyde and Berwyn systems.

Carthage, Mo.—(Special.)—D. King, cy. engr., says that about 6,000 feet of trunk and 4,000 feet of lateral sewers will be constructed.

Indiana, Pa.—Plans have been prepared for a sewerage system to cost about $60,000. The question will be submitted to vote. D. B. Taylor, cy, clk.

Frankfort, Ind.—(Special.)—Chas. E. Cheney, cy, engr., says that 13,305 feet of 10, 8, 6-inch lateral sewers, with lampholes and manholes, will be constructed.

Rutland, Vt.—The bids received May 20 for sewer pipe have been rejected, and the purchasing agent has been authorized to advertise for new ones.

Syracuse, N. Y.—The estimated cost of a 33-inch brick sewer from Grumbach-ave. to Teall-ave. is $45,000, and of a web tile sewer $35,000. C. A. Sweet, cy. engr.

Indianapolis, Ind.—A resolution has been adopted to build an 8-foot main sewer in E. Michigan-st., from Rural-st. to Pogue's run; estimated cost, $90,000. B. J. T. Jeup, cy. engr.

Sebring, O.—This town desires plans and specifications for a sanitary sewer with disposal plant. The proposed sewer is 5 miles long, of which 2 miles will be main sewers.

Columbus, Ga.—(Special.)—Robert L. Johnson, supt. pub. wks., says the proposition to issue $125,000 bonds for building a sewerage system was defeated at the election held May 9.

Fargo, N. D.—(Special.)—Samuel F. Crabbe, cy. engr., says that 6,000 feet of pipe sewers is contemplated for the State Agricultural college and 400 feet of 12-inch pipe sewers on Fifth-st., N.

Ashland, Wis.—The council is considering certain propositions for preparing plans and specifications for a sewerage system

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which will require 12 to 15 miles of pipe, and include a disposal plant.

Petaluma, Cal.—(Special)—N. S. Frost, cy. engr., says that the board of trustees passed resolutions of intention, May 20, to construct about 4,600 ft. of 8-in. pipe sewers and 3,600 ft. of 6-in. sewers.

Swissvale, Pa.—A committee has been appointed to confer with committees from Edgewood, North Braddock, Rankin and Braddock councils relative to building a sewer for the fire boroughs down Hawkins hollow, a distance of 3 miles. The estimated cost is $40,000.

Erie, Pa.—The Mill Creek commission invited Chas. C. Brown, of Indianapolis, George S. Pierson of Kalamazoo, Mich., and Wm. Farquhar, of Waring, Chapman & Farquhar, of New York City, to examine and report upon the conditions existing on account of the open stream known as Mill Creek, flowing through this city, and into the bay from which the city's water supply is derived.

CONTRACTS TO BE LET.

Marinette, Wis.—Bids are asked until June 4 for building a sewer in Wells-st. W. H. George, clk.

Appleton, Wis.—Bids will be received June 5 for 1,200 ft. of 9-in. sewer. C. H. Gillett, cy. surv.

Des Moines, Ia.—Bids are asked until June 8 for a 12-in. pipe sewer. G. A. Eberhart, chmn. B. P. W.

Campbelltown, N. B.—Bids are asked until June 1 for constructing a sewerage system. Wm. Murray, chmn. coun.

Pullman, Wash.—Bids are asked until June 5 for a 5,000 lin. ft. of 8 and 10-in. pipe sewers. Prof. W. J. Roberts, engr.

Redfield, S. D.—Bids are asked until June 3 for constructing a sewer in Emerson-st. and Franklin-ave. J. S. Huston, cy. audt.

Sacramento, Cal.—Bids are asked until June 5 for constructing 42 to 22-in. brick sewers in several streets. M. J. Desmond, cy. clk.

Waterbury, Conn.—Bids will be received until June 4 for building sewers on West and Main-sts., from Leavenworth to Church-st.

Washington, D. C.—Sealed bids are asked until June 5 for a sewer and water system at Riverside, Cal. W. A. Jones, com'r Indian Affairs.

Stanley, Ont.—Bids are asked until June 10 for drainage work to include about 50,000 cu. yds. of earth work. J. E. Harmwell. clk. Varna.

Des Moines, Ia.—Bids are asked until June 10 for a 15 and 12-in. vitrified clay pipe sewer in E. Ninth-st. G. A. Eberhart, chmn. B. P. W.

Omaha, Neb.—Bids will be received until June 7 for constructing a sewer in district No. 258. Andrew Rosewater, chmn. B. P. W.

Washington, D. C.—Sealed bids are asked until June 1 for furnishing sewer bricks, invert blocks and sewer pipe to the District of Columbia. H. B. F. MacFarland, chmn. dist. com'rs.

Dayton, O.—Bids are asked until June 11 for building 4,760 lin. ft. of 8-in., 1,970 ft. of 10-in., and 6,730 ft. of 4-in. sewers, with 15 manholes, etc. Robert H. Ferguson, cy. compt.

Washington, D. C.—Sealed bids are asked until July 12 for furnishing and erecting the pumping machinery, boilers and auxiliaries required to equip the sewerage pumping station. H. B. F. MacFarland, chmn. dist. com'rs.

New York City—Sealed bids are asked until June 5 for constructing sewers in the Borough of Brooklyn, as follows: Tenth-ave., from 77th to 62d-st.; 62d-st., from 16th to 6th aves.; 6th-ave., from 62d to 64th-st.; 64th-st., from 6th-ave. to New York Bay. Jas. Kane, com'r sewers.

South Bend, Ind.—Sealed bids are asked until June 1 for the construction of sewer and water connections on W. Water-st., from Michigan to Taylor. Bids are asked until June 5 for a sewer on Mill-st. Arthur L. Hubbard, cy. engr.

New Orleans, La.—Sealed bids are asked until July 3 for the construction of a pumping station, known as St. Bernard No. 3, lined and covered canals in Third-st., of Nashville-ave., St. Bernard, Algiers, Lowerline and Leonidas systems of drainage, and open and unlined canals in the Algiers system of drainage. R. M. Walmsley, prest. drainage commission.

CONTRACTS AWARDED.

Sidney, N. Y.—Chas. Wood and James Jameson secured the contract for building a sewer in Cortright-ave.

Albany, N. Y.—The contract for building a sewer in Watervliet-ave. was awarded May 14 to John Doyle.

Jeffersonville, Ind.—The contract for building a sewer from the jail to Meigs-ave. was awarded to Harry Baxter.

Bennington, Vt.—The contract for building a sewer was awarded to H. S. Eveline & Co. of Waterford for $8,500.

Perry, N .Y.—The contract for a sewerage system was awarded to the Troy Public Works Co. of Utica for $49,000.

Emeryville, Cal.—The contract for building a sewerage system was awarded to Williams, Beiser & Co. of San Francisco.

Binghamton, N. Y.—The contract for building a sewer in Griswold-st. was awarded to Whalen & Matthews for $11,-987.

New York City.—The contract for building sewers in Morris-ave. and 182d-st. was awarded to Murray & McAvoy for $21,383.

Salt Lake City, Utah.—Parry & Swenson was awarded the contract May 14 for constructing 15,400 ft. of sewers for $18,712.

Danville, Ky.—The contract for building a sewerage system was awarded to A. L. Patterson & Co. of Norfolk, Va., for $21,-118.

Kansas City, Mo.—The contract for building an outlet to the O. K. creek sewer was awarded May 4 to Black & Laird for $126,-771.25.

Bennington Center, Vt.—The contract for building 16,400 ft. of pipe sewer was awarded to Michael F. Dollard of Albany, N. Y., for $8,580.

McKeesport, Pa.—James Stratton secured the contracts for building sewers in Ninth, Eighth and Ridge-aves. and Hurrel and Welser alleys.

Milwaukee, Wis.—The contract for building section No. 2 of the west side intercepting sewer has been awarded to Geo. E. Zimmerman at $6.18 a lin. ft.

Boston, Mass.—The contract for building section 49 of the high level sewer at Quincy was awarded May 13 to C. G. Belden

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& Co. of Melrose for $69,350. This firm was also awarded the contract for culverts and embankments, sections 48 and 49 of the high level sewer, at Quincy, for $70,175.

Marquette, Mich.—The contract for constructing a sewer in Champion-st. was awarded May 10 to John Plattenberg at 39 cts. a lin. ft. and $50.00 for manholes.

Toledo, O.—Sewer contracts were awarded May 16 as follows: Patrick Tansey, sewers in Leonard and Elmore-sts.; J. B. O'Neill, sewer in alley south of Walbridge-ave.

Jamestown, N. Y.—Bids were received May 17 for building 30,000 ft. of tile sewers as follows: Mahoney Bros. & Gardner, Jamestown, $37,297; Gust Burland, Jamestown, $37,833; Jamestown Construction company, Jamestown, $38,317.

Erie, Pa.—Sewer contracts were awarded May 2 as follows: German-st., Michael Murphy, 12-in pipe, straight $1; 9-in., 24 cts.; 6-in., 24 cts.; 12-in. Y or T joint, $1.50; manholes, $36. Fifth-st., John McCormick & Son, 12-in. pipe, straight 50 cts.; 9-in., 30 cts.; 6-in., 25 cts.; 12-in. Y or T joint, 50 cts.; manholes, $35. Another section of Fifth-st., John McCormick & Son, 15-in. pipe, straight, $1.; 9-in., 40 cts.; 6-in., 30 cts.; 15-in. Y or T joint, $1; manholes, $40.

WATER-WORKS.

White Plains, N. Y.—The plant of the New Suburban Water company was sold at auction May 3d to satisfy first mortgage bonds for $208,000, with interest, held by the Atlantic Trust company.

Alton, Ill.—The Alton Municipal Water company has been organized by the Hon. H. G. McPike, A. L. Daniels and Joseph E. Porter. The object of the new company is to gain control of the plant that now supplies this city with water, and to turn it over to the city within a year.

CONTEMPLATED WORK.

Kennett Square, Pa.—The water works will be improved.

East Randolph, N. Y.—The water works system will be extended.

Georgetown, S. C.—Plans for a water works system are being made.

Rome, N. Y.—This city voted May 18 in favor of a gravity system of water works.

Lorain, O.—The water works trustees have decided to install a meter system.

Waitsburg, Wash.—The water system will be extended at a cost of $10,000.

La Crosse, Wis.—The question of installing water meters is being considered.

Reading, Pa.—Contracts will be let soon for the enlargement of the Egelman reservoir.

Waupaca, Wis.—The question of improving the water supply is being considered.

Cadott, Wis.—This city is ready to receive plans for water works. J. H. Munroe, prest.

Newburg, N. Y.—The question of issuing bonds for enlargement of water works will be voted on.

Baraga, Mich.—A preliminary survey is being made for a water works system for this town.

Ft. Wayne, Ind.—The bids opened April 23 for an air-lift pumping plant for this city were rejected and new plans will be prepared and new bids asked.

Spokane, Wash.—The extension of water mains in Lidgerwood Park to Kenwood is contemplated.

Amherst, Mass.—The extension of the water works system to North Amherst 2½ mis. is proposed.

Glidden, Wis.—Plans have been accepted and contracts will be let soon for a water works system.

Baldwin, Kas.—Plans for a water works system are being made by Burns & McDonnell of Kansas City, Mo.

Flora, Ill.—The city council has decided to pipe water from the Little Wabash river, a distance of 4½ mis.

Pagosa Springs, Col.—Contracts for the proposed water works will be let about July 1st. R. A. Howe, engr.

The question of municipal water works is being considered at the following places: Mattoon, Ill.; Oswego, N. Y.

Fargo, N. D.—(Special.)—Sam'l F. Crabbe, cy. engr., says about 400 ft. of 4-in. pipe will be laid on Fifth-st.

Holland, Mich.—The residents on Thirteenth-st. have petitioned for a large water main on that street from Pine to Maple.

Kankakee, Ill.—The Kankakee W. W. Co. contemplates putting in about one mile of 12-in. pipe, a new pump and boiler.

Kokomo, Ind.—The council purchased, May 7, four acres of vacant ground for the establishment of municipal water works.

Rochester, Ky.—J. D. Baugh, cy. clk., desires prices on material required in the construction of water works system.

Missoula, Mont.—The Missoula Water company contemplates building 17,000 ft. of 30-in. stave pipe flume and a 1,000,000-gal. reservoir.

Rantoul, Wis.—The water works committee has formulated a plan to build a brick tower and new tank. The plans and specifications will be ready June 1.

Norway, Mich.—The bill authorizing the extension of a water works and electric light system has been signed by Governor Bliss.

Gloucester, Mass.—Mayor French has approved an ordinance to appropriate $100,000 for improving the present sources of water supply.

Savona, N. Y.—A water works system will be constructed here by John F. Carpenter of Galeton, Pa., if sufficient patrons can be secured.

Santa Barbara, Cal.—This town voted May 9 to issue $60,000 water bonds for the extension of the water mains and the establishment of another reservoir.

San Diego, Cal.—(Special.)—F. H. Dixon, secy. B. P. W., says that this city is about to acquire a water distributing system. The bonds will be sold June 17.

Paris, Ill.—(Special.)—W. C. Lemen, cy. engr., says that some extension of water mains is contemplated and that a new pumping engine will be installed some time this summer.

The question of issuing bonds for water works construction will be voted on as follows: Imogene, Ia.; Tullahoma, Tenn., June 6th.; Guthrie, O. T.; Montezuma, Ga., July 2; Helena, Mont.

Davenport, Ia.—Plans are being considered

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for the enlargement of the present filtration plant, and the construction of a sedimentation basin. Jas. B. Donahue, secy. Davenport Water company.

The question of issuing water works bonds has been favorably voted at the following places: Earlville, Ia.; Garretson, S. D.; Stanley, Wis.; Buhl, Minn.; Jasper, Minn.; Hanover, Ont.; Colquet, Minn.; Havre, Mont.

Meadville, Pa.—Rudolph Hering and Geo. W. Fuller of New York City have been engaged for preliminary investigations for a new source of water supply, or the improvement of existing water supply from French Creek.

The extension of water mains is contemplated at the following places: Elgin, Ill.; Colorado Springs, Colo.; Plymouth, Ind.; Millville, Pa.; Fall River, Mass.; Seattle, Wash.; Benson, Minn.; Juneau, Wis.; Rochester, N. Y.

The construction of water works systems is contemplated at the following places: Wausa, Neb.; Woodsfield, O.; Forsythe, Mont.; Osceola, Ia.; Elliott, Ia.; Jefferson, Wis.; Farmington, Me.; Bird Island, Minn.; East Chattanooga, Tenn.; Phoenix, B. C.; Moundridge, Kans.; Pierce, Neb.; Paulding, O.; Pattonsburg, Mo.; Merrillan, Wis.; Sussex, N. B.; McIntosh, Minn.; Worthington, Minn.; Winslow, Me.; Brownsville, N. Y.; Lompac, Cal.; Ellisville, Miss.; Sturgeon Bay, Mich.; Ionia, La.; Park River, N. D.; Comanche, I. T.; Harvey Grove, Tex.

CONTRACTS TO BE LET.

Jackson, Tenn.—Bids are asked until June 3 for a water works system.

Glen Rock, Pa.—Bids are asked until June 4 for a w. w. system. Harvey A. Koller, boro clerk.

Winnipeg, Man.—Bids are asked until June 10 for 50 6 and 8-in. hydrants. J. C. Brown, cy. clk.

New London, Conn.—Bids are asked until June 3 for furnishing all and laying a quantity of water pipe.

New Matamoras, O.—Bids are asked until June 10 for water works. John W. Berents, vil. clk.

Mt. Pleasant, Tenn.—Bids are asked until June 3 for a water works system. Granberry Jackson, engr.

Lamberton, Minn.—Bids are asked until June 5 for building a water works system. R. Fritsche, vil. rec.

Joliet, Ill.—Bids are asked until June 17 for improving the water works system. W. F. McMasters, cy. clk.

Boone, Ia.—Bids are asked until June 5th for sinking a 10-in. well to a depth of 200 ft. C. E. Russell, cy. engr.

Warren, Ill.—Bids are asked until June 5th for drilling a 10-in. well from 700 to 1,000 ft. deep. P. T. Hicks, chmn.

Albert Lea, Minn.—Bids are asked until June 3d. for laying 2,382 ft. of 6-in. water mains, hydrants, etc. C. E. Brainerd, cy. clk.

Rimouski, Que.—Bids are asked until Aug. 1 for a water works and electric light system. F. Demers, 4 St. Peter-st., engineer in charge

Binghamton, N. Y.—Sealed bids are asked until June 6 (postponed from May 27) for the construction of a mechanical filter at the water works. John Anderson, secy. bd. water com'rs.

Sheridan, Wyo.—Bids are asked until June 2d. for a dam and filter bed, and for extending the water system about three miles. W. H. Stotts, town clerk.

Sault Ste. Marie, Mich.—Bids are asked until June 10th for furnishing 62 fire hydrants. G. W. Chance, ch. engr. Tagona Water & Light company.

Northampton, Mass.—Sealed bids are asked until June 7th for the extension of the Northampton Water Supply System. E. C. & E. E. Davis, engrs.

Washington, D. C.—Sealed bids are asked until June 5th for water and sewerage systems at Riverside, Cal. W. A. Jones, comr. Indian Affairs.

Minneapolis, Minn.—Bids are asked until June 28 for one or two 10,000,000 or 15,000,000-gal. pumping engines for the new pumping station. G. W. Sublette, cy. engr.

New York City—Bids are asked until June 13 for a tank standpipe, pumping engines, boilers and appurtenances for the high service works on Jerome-ave. Wm. Dalton, comr. water sup.

Chicago, Ill.—Bids will be received until June 1 for boilers, steam and water piping for the village of Riverside. C. V. Kerr, Armour Institute of Technology, Thirty-third and Armour-ave.

Cincinnati, O.—Sealed bids are asked until June 18 for three self-contained vertical triple expansion crank and flywheel pumping engines of 25,000,000 gals. each and three of 12,000,000 gals. each. Aug. Herrman, prest. bd. trustees, com'rs. of w. w.

Tuscon, Ariz.—Sealed bids are asked until June 20 for furnishing and delivering 7,200 ft. 6-in. cast iron pipe; 15 6-in. cast iron T's; 15 6-in. cast iron crosses; 30 6-in. cast iron plugs; 6,000 lbs. of pig lead; 400 lbs. of yarn; 3 6-in. gate valves 15 fire hydrants, fittted with oil steamer and two 2½-in. hose nozzles. N. E. Hawke, cy. rec.

CONTRACTS AWARDED.

Chicago, Ill.—The contract for laying water mains in certain streets was awarded to Jas. J. Renn.

La Crosse, Wis.—The contract for laying a water main was awarded to Thill & Lapitz, for $2,700.

Honey Grove, Tex.—A franchise for a water works system has been granted to W. D. Wilkins, and associates.

Ft. Lincoln, N. D.—The contract for a water works system was awarded to Walter Graham of Bismarck for $10,300.

Minneota, Minn.—The contract for a water works system was awarded to W. D. Lovell of Des Moines, Ia., for $13,055.

La Salle, Ill.—The contract for constructing water works was awarded to John Cherry of Jacksonville, Ill., for $92,800.

Boston, Mass.—The contract for building section 13 of the Western aqueduct was awarded to M. H. Keefe of Yonkers, N. Y.

Washington, Pa.—The contract for installing a filtration system of 3,000,000 gals. per day was awarded, May 15, to the Pittsburg Filter Mfg. Co.

Detroit, Mich.—The contract for furnishing 36 to 42-in. iron pipe was awarded to the American Car & Foundry Co. of St. Louis, Mo., at 21.75 a ton.

Atlanta, Ga.—The contract for furnishing

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cast iron water pipes was awarded, May 18, to the Dimmick Pipe Co. of Birmingham, for $103,735.62. The contract for the valves was divided between the Dimmick Co., for $3,427.60, and the Rensselaer Mfg. Co. of Troy, N. Y., for $7,850.

BRIDGES.

Annandale, Minn.—The county commissioners have decided to build a bridge across the Clearwater river.

Jackson, Mont.—Bids are asked until June 4 for a 6-span bridge to cross Big Hole river.

Fowler, Ind.—Sealed bids are asked until June 5 for building six bridges. Ben Davidson, chmn. co. comis.

Shreveport, La.—Bids are asked until June 13 for a steel bridge over Cross Bayou at Market-st. P. P. Keith, prest.

Evansville, Ind.—Bids are asked until June 13 for a plate girder approach to Franklin-st. bridge. Louis H. Lyler, co. audt.

Alexandria, S. D.—Sealed bids are asked until June 8 for building a bridge over Rock creek in Hanson twp. H. P. Benjamin, co. audt.

Terre Haute, Ind.—Sealed bids are asked until June 15 for constructing nine bridges and arches. W. P. Boatman, chmn. co. comis.

Waupaca, Wis.—Bids are asked until June 1 for a stone arch bridge across Little Wolf River on Ogdensburg road. Jacob Wiff, co. comr.

Murdock, Ill.—Bids will be received until June 6 for constructing five bridges for the towns of Murdock and Norman. O. E. Jones, clk. drainage comis.

Dublin, Ga.—Bids are asked until July 15 for extending the present steel bridge over the Oconel river 1,100 ft. J. M. Blackshear, co. coms.

Lancaster, Pa.—Bids are asked until June 5 for a wrought iron and steel bridge across Conestoga creek at Prince-st. David E. Mayer, chmn. co. comis.

Trenton, Mo.—Sealed bids are asked until June 3 for building a wooden bridge, an iron bridge anad repairing an iron bridge. L. D. Spencer, co. bridge comr.

Chicago, Ill.—Sealed bids are asked until July 24 for building bridges across the Chicago river at State and Harrison-sts. Alex J. Jones, prest, bd. trustees.

Columbus, Ga.—(Special)—Robt. L. Johnson, supt. pub. works, says a committee has been appointed to investigate and devise ways and means for replacing one of the old wooden bridges across the Chattahoochee river with a modern steel structure. Mayor L. K. H. Chappell, chmn. com.

PARKS.

Muncie, Ind.—A new park of more than 100 acres of ground will be established.

Rockford, Ill.—The question of converting the fair grounds into a public park is being considered.

San Francisco, Cal.—An ordinance has been introduced which provides for the creation of a park and boulevard commission for the purpose of securing a comprehensive plan of parks and boulevards for this city.

Nashville, Tenn.—A resolution has been adopted to create a park system, each large park to consist of 50 or more acres, and a system of small parks consisting of a number of lots, plots, squares or tracts. Bd. park com'rs.

STREET LIGHTING.

Greenville, N. C.—Plans are being prepared for an electric light plant.

The question of issuing bonds will be voted on at Albany, Ga., and Cartersville, Ga.

Ellisville, Wis.—The contract for an electric light plant will probably be let about June 20.

Rogers, Mich.—Bids are desired for a municipal electric light plant. N. K. Wilson, vil. clk.

Cleveland, O.—Sealed bids are asked until June 5 for an electric light plant for the court house. Co. comis.

Greenville, N. C.—Plans are being proposed for an electric light plant and will probably be let about June 20.

Dayton, Wash.—The question of purchasing the present electric light plant or erecting a new one will be voted on June 4.

Indianapolis, Ind.—The specifications for the new public electric lighting contract have been completed and bids will be asked.

Penn Yan, N. Y.—A committee has been appointed to advertise for sealed bids for lighting the village for one year from July 1, 1901.

Dayton, O.—Bids are asked until June 5 for installing the extension of electric light plant in Central Branch, N. H. D. V. S.

Milwaukee, Wis.—The contract for lighting the streets with naphtha has been awarded to Chas. & L. W. Dunkel for five years at $22.83 per lamp per year for 60 c. p. lamps.

Montreal, Canada—Sealed bids are asked until June 15 for installing and maintaining electric arc and other electric lamps for lighting the streets, etc. L. O. David, cy. clk.

Pittsfield, Mass.—A resolution has been passed providing for the appointment of a committee to consider the advisability of establishing a municipal plant. The committee is to report by Sept. 1.

The question of issuing bonds for building electric light plants has been favorably voted on as follows: Chillicothe, Mo.; Havre, Mont.; Covington, Ga.; Shepardstown, W. Va.; Frankfort, N. Y.; Manistee, Mich.; New London, Ia.

Sharpsburg, Pa.—Bids are asked until June 12 for installing electric light machinery and furnishing arc lamps, mast arms, transformers, etc., and removing and rearranging the present dynamos. Frank A. Smith, chmn. water and light com.

Electric light plants are contemplated at the following places: Fullerton, Neb.; Lebanon, N. J.; Lowell, Mass.; Brownsville, Orc.; Van Etten, N. Y.; Oakland, Cal.; Park River, N. D.; Richfield, Utah; Kissimee, Fla.; Le Clair, Ia.; Dunlap, Ia.; Parkville, Ia.; Treverton, Pa.; Coeymans, N. Y.;

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Middleport, O.; Ravenswood, Va.; Santa Paula, Cal.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Sharon, Pa.—The purchase of a street sweeper is contemplated.

Des Moines, Ia.—The question of street cleaning is being considered.

Cohoes, N. Y.—Contracts will be let soon for cleaning paved and unpaved streets.

Medina, N. Y.—The contract for collecting garbage has been awarded to Frank Silk.

Paris, Ill.—(Special.)—W. C. Lemon, cy. engr., says the purchase of a small street sweeper is contemplated.

Milwaukee, Wis.—The contract for sweeping the paved streets was awarded, May 13, to Chas. Farrestal for three years.

Meadville, Pa.—The Meadville Improvement Society offers to furnish all tools necessary to clean the paved streets of this city, provided the council will furnish the labor.

Atlanta, Ga.—The contract for garbage cremation has been awarded to J. F. Lester for 1½ years at $1,250 per month for June, July, August and September, and $1,000 per month for the other months.

TOO LATE FOR CLASSIFICATION

Williamstown, Pa.—The street lighting question is being agitated.

Randolph, Vt.—This village voted to macadamize two of the principal streets.

Oak Park, Ill.—The erection of a sewer in South Boulevard is being discussed.

Norfolk, Va.—The Atlantic Light & Water Co., Virginia Beach, Va., has been chartered.

Des Moines, Ia.—E. E. Dorr, alderman from the Third ward, recommends the paving of cross streets.

Danville, Ill.—The contract for curbing Gilbert-st., was awarded, May 17, to J. H. Palmer at 30 cents a foot.

Clarksville, Tenn.—A ten-year contract has been awarded the Queen City Electric Light Co., for all-night street lights.

Cincinnati, O.—The board of public service decided, May 20, to repave five streets on Mt. Adams with brick.

Correctionsville, Ia.—The council has decided to expend $1,000 in extending the water service.

Wichita, Kas.—City Street Commissioner Allen recommends a system of refuse and waste paper boxes.

Orrville, O.—The question of issuing $15,000 bonds for a municipal electric light plant will be voted on June 27.

Colorado Springs, Colo.—Sealed bids are asked until June 1 for extending the water mains. K. M. MacMillan, cy. engr.

Doylestown, O.—An ordinance has been passed authorizing the issue of $10,000 bonds for building or purchasing an electric light plant.

Cheyenne, Wyo.—Bids are asked until June 14 for building a bridge across the Laramie river at Fort Laramie. Dallas R. Cowhick, co. clk.

Gloucester, N. J.—The contract for building 800 feet of 16x20 in. brick sewer was awarded, May 17, to Frank Burt, of Camden, at $1.20 a lin. ft.

Anderson, Ind.—Ordinances were passed May 20 for brick paving, cement walks and sewers on 14 streets, the award of contracts to begin June 11 and ending July 17.

Marine City, Mich.—The committee appointed to investigate the cost of paving reports the following: Asphalt, 28½ cts. a sq. ft.; brick, 19½ cts.; cedar blocks, 14½ cts.. The committee has been retained to secure further estimates and to interest contractors in the proposed work. George N. Jones, chmn. com.

Ottumwa, Ia.—The contract for constructing the South Ottumwa sewer was awarded May 20 to John W. Scott, at $6.37½ a lin. ft. for the sewer; $3.50 a lin. ft. for hydraulic cement and concrete foundation; $1.50 a lin. ft. for coarse limestone foundation; $1.75 for coarse gravel foundation.

Detroit, Mich.—Contracts for repaving were awarded May 20 as follows: Junction-ave., from Dix to M. C. R. R. tracks, John Mercier, Buckeye brick, $1.72 a sq. ft. or $19,736; Cass-ave., from Holden to Amsterdam, Barber Asphalt Paving Co., asphalt, $16,688; Baltimore-ave. and Foundry-st., cedar block on concrete, Julius Porath, $1.25 a sq. ft.

Chicago, Ill.—The board of local improvements authorized, May 24, the construction of 6 mls. of asphalt paving. The most important work will be Indiana-ave., between Eighteenth and Thirty-ninth-sts. The contract for extending the Thirty-ninth-st. intercepting sewer 500 ft. from Lake-ave. to east of the Illinois Central right-of-way, was awarded to Agnew & Co., at $1.95 a ft.

Indianapolis, Ind.—A resolution was adopted May 27 to pave Pratt-st. from New Jersey to Park-ave. with asphalt. Bids were received recently for this work but were returned unopened because the board was undecided. New bids will be asked. Final action was taken for asphalt paving in Thirteenth-st., between College and Bellefontaine, and Eleventh-sts., between Bellefontaine and the C. I. & L. tracks.

Syracuse, N. Y.—The Empire Contracting Co. submitted the lowest bids May 20 for asphalt paving in eight streets, at prices ranging from $1.60 to $1.75 a sq. yd. F. J. Baker was the lowest bidder for brick paving at $1.70 and $1.72. The Warner-Quinlan Asphalt Paving Co. was the lowest bidder on two streets, including Gifford-st., and the Barber Asphalt Paving Co. was lowest on Warren-st. The Warren Asphalt Paving Co. submitted the lowest bid for resurfacing James-st., but owing to the bid being informal the contract will be awarded to the Empire Contracting Co.

Sioux Falls, S. D.—Mayor Burnside has been authorized to install a municipal lighting plant.

Kendrick, Idaho—An electric light franchise has been granted to C. H. Kimmel.

Neosho, Mo.—The capacity of the plant of the Neosho Electric Light company will be enlarged.

Canton, N. Y.—The purchase of a pumping engine is proposed.

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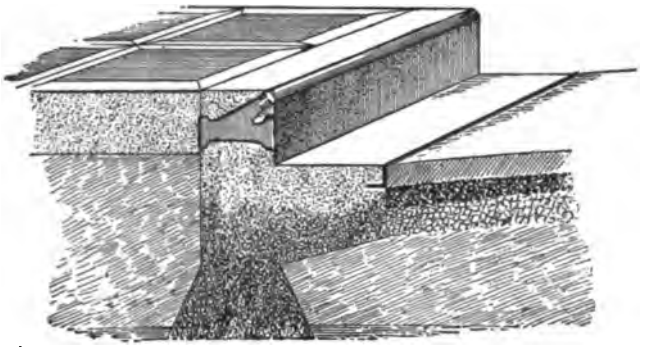

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WANTED.—An engineer, at present city engineer in a northern city, who has had an extensive experience in hydraulic, sanitary and municipal work, wishes a location farther south or southwest in the capacity of city engineer, in a city of at least 25,000 population, or as assistant engineer in larger place. Best of references.

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care MUNICIPAL ENGINEERING.

WANTED.—By a young man, a position as superintendent of a water-works, who has had seven years' experience as such; is a practical steam engineer and machinist. Can give good references.

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Seven thousand two hundred and fifty feet of standard weight six-inch cast-iron pipe.

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For further particulars, address

N. E. HAWKE,
City Recorder, City of Tucson.

NOTICE TO CONTRACTORS.

Office of City Civil Engineer, May 8, 1901.

Sealed proposals will be received by the Common Council of the city of Crawfordsville, Indiana, at this office, until 4 o'clock P. M., June 8, 1901, for furnishing the necessary labor and materials for the improvement of both sides of Mill street from Main street to Wabash avenue, by cement sidewalks, five feet in width and five inches in thickness; also, a cement gutter thirty inches in width and five inches in thickness, according to the plans and specifications therefor, on file in the office of the City Civil Engineer.

Each bid must be accompanied by an acceptable bond of an equal amount with Montgomery county freehold security.

Said improvement to be completed within 60 days from the time of letting. Bidders are required to use the printed forms, which will be furnished on application.

The Common Council reserves the right to reject any or all bids.

By order of the Common Council.

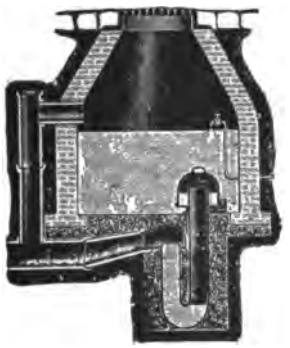
E. S. SIMPSON, City Civil Engineer.

NOTICE TO SEWER CONTRACTORS.

Notice is hereby given that sealed proposals or bids will be received at the City Clerk's office of the city of Marinette, up to 12 o'clock noon of Tuesday, June 4, 1901, for the construction, in accordance with the plans and specifications now on file in said office, of the following improvement in said city: A vitrified pipe sewer, with appurtenances, on Wells street, from the present brick sewer, between the C. & N. W. and C. M. & St. P. side-tracks, northerly, to within a point of about eighty (80) feet south of the south line of Main street. The contractor is to furnish all tools, labor and material required. All bids shall be made out on blanks furnished by the Board of Public Works and accompanied by a certified check for the sum of $100. The Board of Public Works reserves the right to reject any or all bids.

Dated May 15, 1901.

W. H. GEORGE,
W. J. DAVIS,
JAS. BRICK,
M. J. FEENEY,
A. L. HILLIS.



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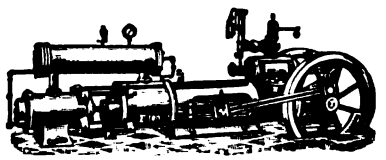

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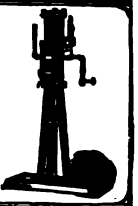

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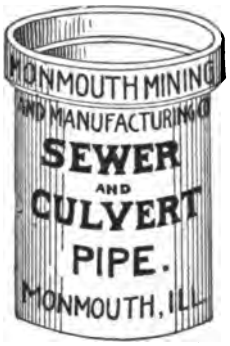

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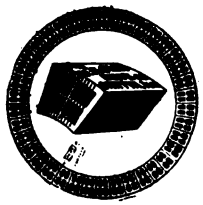

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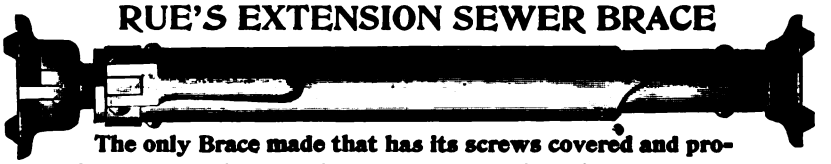

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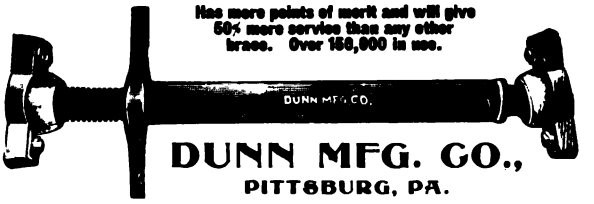

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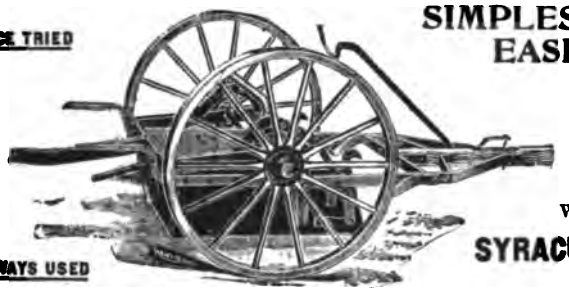

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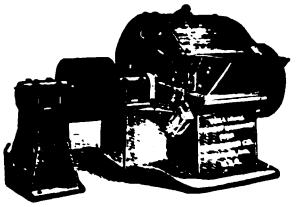

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CRUSHERS AND PULVERIZERS FOR ALL PURPOSES. ASPHALTUM, ORES AND CEMENT MATERIAL.

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HAS THREE CLAIMS UPON THE PUBLIC

Sprinkles, Sweeps and Carts Away the Dirt Without the Aid of Hand Labor.

Economy, Sanitation and the Elevation of Labor.

TO THE HONORABLE STREET COMMISSIONER OF GREATER NEW YORK:

Dear Sir—Believing as we do that by the adoption and use of the "Layman and Parpart Sanitary Street Cleaner" you can largely improve the sanitary conditions of this city, thereby materially reducing sickness, suffering and the consequent death rate, and that you can keep the streets clean sixteen hours per day at as small or smaller cost than is now required to maintain an inferior service eight hours per day, we therefore respectfully request that you immediately employ this modern and sanitary means of removing street dirt, dust and refuse, without circulating the same in the open air, which always results in discomfort and often in disease and death, as well as in soiling our clothing, goods, offices and homes.

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The Above Names are a Few of the 7,000 Business Firms Who Have Signed the Petition

UNITED STATES STREET CLEANING CO.,

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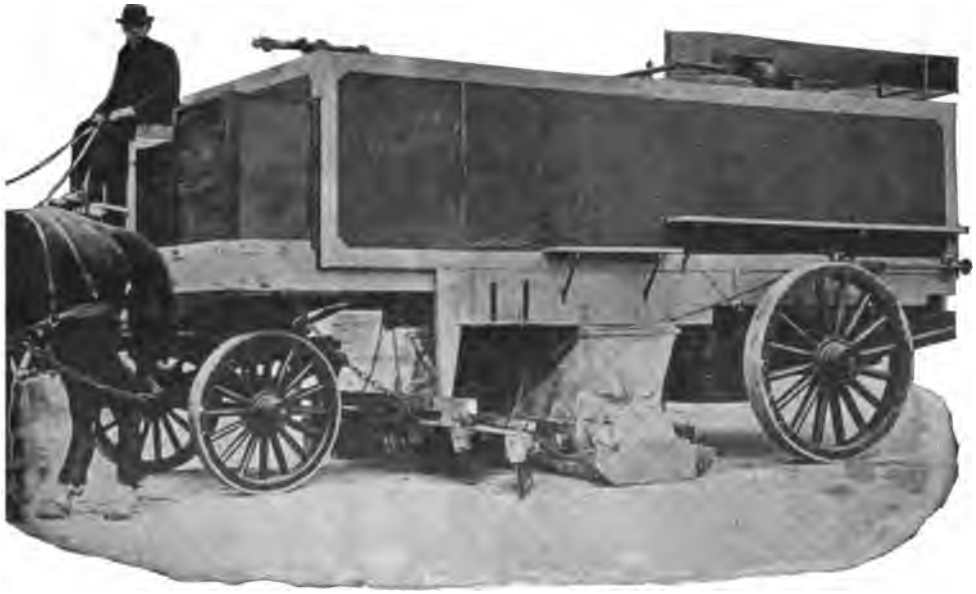

The FURNAS PNEUMATIC STREET CLEANER

- It Cleans with an Air Blast.
- No Other Like It.
- Streets Swept Frequently by this Machine Need no Day Sprinkling to Keep Down the Dust.
- Popular with the Merchant and the Housekeeper—A Joy to Wheel Riders.
- Leaves the Street Clean as Flushing.
- Sweeps Ten Feet Wide.
- Makes no Dust.
- No Brushes to Renew.
- Is Nearly Noiseless.
- One Sweeping with this Machine is Better than Two by Other Methods where the Street Must be Sprinkled.
- It is the Chief Method of Accomplishing what is done at vastly Greater Expense by Hand Labor.

Adapted to Work on Any Smooth Street—Dressed Stone, Wooden Block, Asphalt or Brick

THE BEST OF ALL

The Furnas Pneumatic Sweeper is the only Street Cleaning Machine that ever received the approval of the late Col. Waring, Street Cleaning Commissioner of New York.

City Engineer Fisher, Rochester, N. Y., says—"It seemed to do the work of cleaning in a sort of magic manner, for when it had passed, the coarse dirt and best of all the fine dust, were nowhere to be seen."

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CHAMPION GUTTER CLEANER.—A one-horse machine, simple in construction. Automatically adjusts itself to any unevenness of streets, cleans the gutter more perfectly than can be done by hand, and delivers the dirt two feet from the curb. Can be operated for one-half the cost of any other gutter cleaner on the market.

STREET CLEANERS' SUPPLIES.—Scrapers, Hand Brooms, Push Brooms, Brushes. Our new Street Scraper for Asphalt is the only Hand Scraper on Wheels, with Dirt Attachment.

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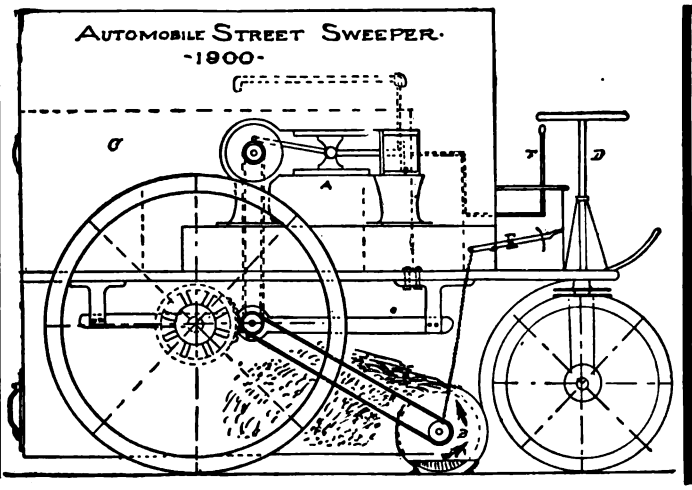


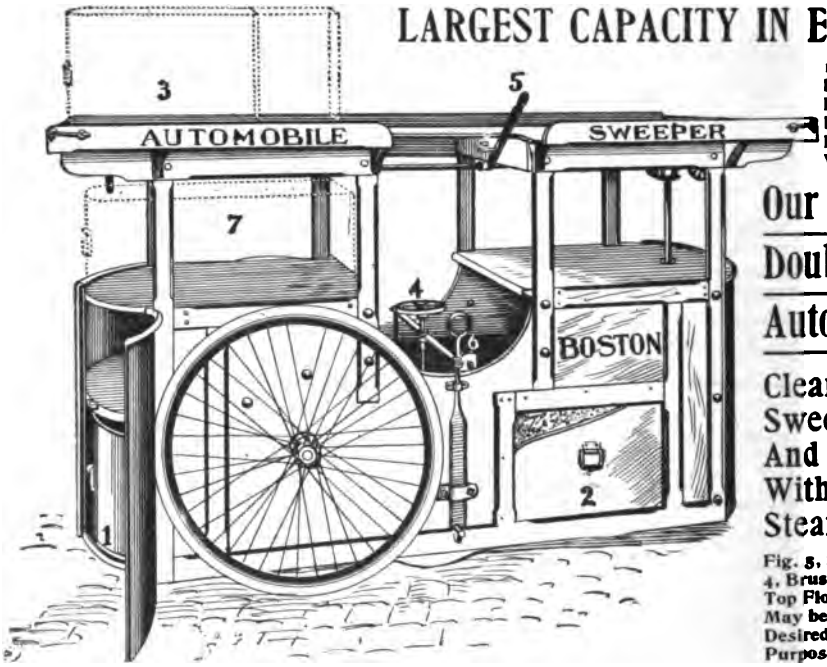
New Century Automobile Street Sweepers

For Light Work

NO STEAM
NO DUST

We are prepared to do all kinds of city cleaning without horses, SAVING SIXTY-FIVE PER CENT. OVER ANY OTHER SYSTEM—Automobiles that sweep and sprinkle at the same time.

LARGEST CAPACITY IN EXISTENCE



1, 2, 3, 7, Dirt Bins, Stored Full on Three Floors and on the EXTENDED ROOF When Loaded.

Our Latest Double-Header Auto. Sweeper

Cleans Gutters, Sweeps, Loads And Sprinkles With Condensed Steam.....

Fig. 5, Steering Lever.
4, Brush Controller.
Top Floor or Roof May be Extended to Any Desired Size for Storage Purposes.

Extract from the Official Report, just issued for 1900, by Mr. CHAS. A. BROWN, Supt. of Streets of the City of CAMBRIDGE, MASS.

"For this purpose a sweeper built by the **Automobile Street Sweeping Company** of Boston was purchased, and has proven to be the **most effective** machine for this work that I have yet seen. The machine is driven at a fast walk, and by an ingenious arrangement of sprocket and chains, the brooms are made to revolve rapidly, throwing the dirt three feet from the curb. By this machine the **corners and sides of gutters can be cleaned as thoroughly as with an ordinary house broom**. As this machine is not obliged to stop to unload, or for any purpose, it can easily keep the gutters swept ahead of the other machines, **and as soon as another one can be obtained it should be added to our present equipment.**"

(Extract from Superintendent's Report.) CHAS. A. BROWN, Supt., Cambridge, Mass.

N. B.—The above announcement is very important to all cities. "**Driven at a fast walk,**" the speed given by the Commissioner of Streets, means 4 to 5 miles an hour, or **30 to 40 miles per day**, and a saving of at least **$50 per day** for the city or contractor on each machine. We are now prepared to receive orders for our **new Combination Automobile Machines**, which sprinkles, cleans the gutter, sweeps the streets, and loads the sweepings at the same time, and may also be used independently for sprinkling or sweeping, showing no steam or dust, thus practically doing the work of **three pairs of horses, drivers and complete outfits.** Prices and particulars on application by responsible parties at company's office.

AUTOMOBILE STREET SWEEPING CO., 185 Summer St., Boston, Mass.

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The "Studebaker"

PATENT SPRINKLER

With....

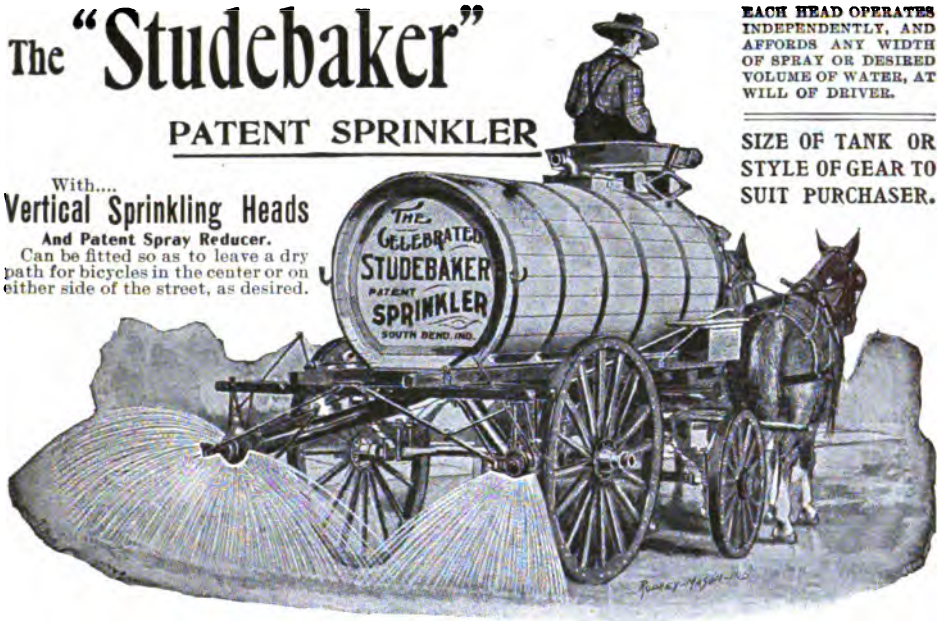
Vertical Sprinkling Heads

And Patent Spray Reducer.

Can be fitted so as to leave a dry path for bicycles in the center or on either side of the street, as desired.

EACH HEAD OPERATES INDEPENDENTLY, AND AFFORDS ANY WIDTH OF SPRAY OR DESIRED VOLUME OF WATER, AT WILL OF DRIVER.

SIZE OF TANK OR STYLE OF GEAR TO SUIT PURCHASER.



Note operation of patent device for controlling width of spray and regulating volume of water at will of driver, giving the "Studebaker" ☞ **AN IMPORTANT ADVANTAGE OVER ALL OTHER SPRINKLERS.**

Either Perforated or Slot Sprinkling Heads

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A Few Reasons Why the AUSTIN STREET SPRINKLERS Are the Best:

1. Tank is attached to steel frame and will not rot out.
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4. All Austin Sprinklers have side cut off. Spray can be varied from 5 ft. to 25 ft.
5. Spray can be adjusted from light to heavy instantly without stopping the team.
6. If you want to know other reasons send for catalogue.

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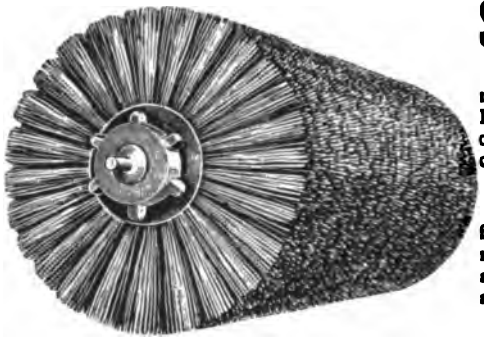

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Ship us the roll as it comes from the machine. We clean it out and refill with Bass, Bamboo, Rattan, or Steel Wire, as ordered. Can furnish any of these materials cut to lengths.

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A hand machine for sweeping lawns, sidewalks and paved streets.

Designed for Parkmen, Cemetery Associations, Landscape Gardeners, Municipalities and all lovers of beautiful lawns and clean streets . . . . .

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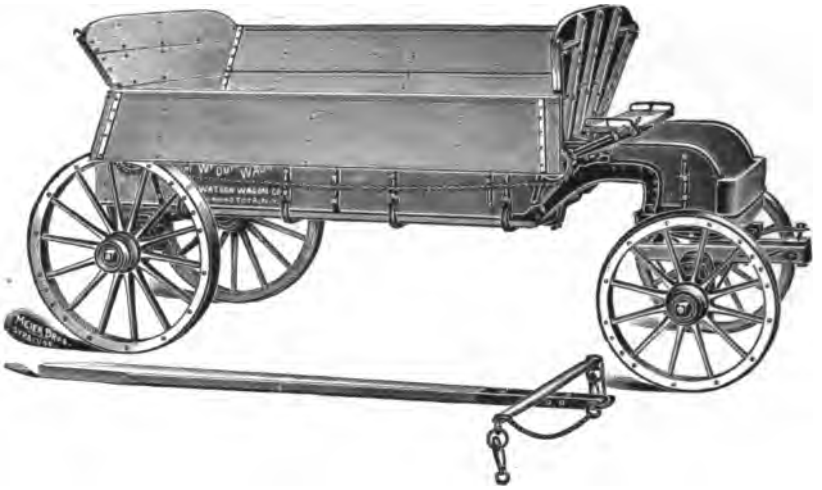

They are dumped instantly, by a mere touch, and closed without stopping the team. Turn in their length.

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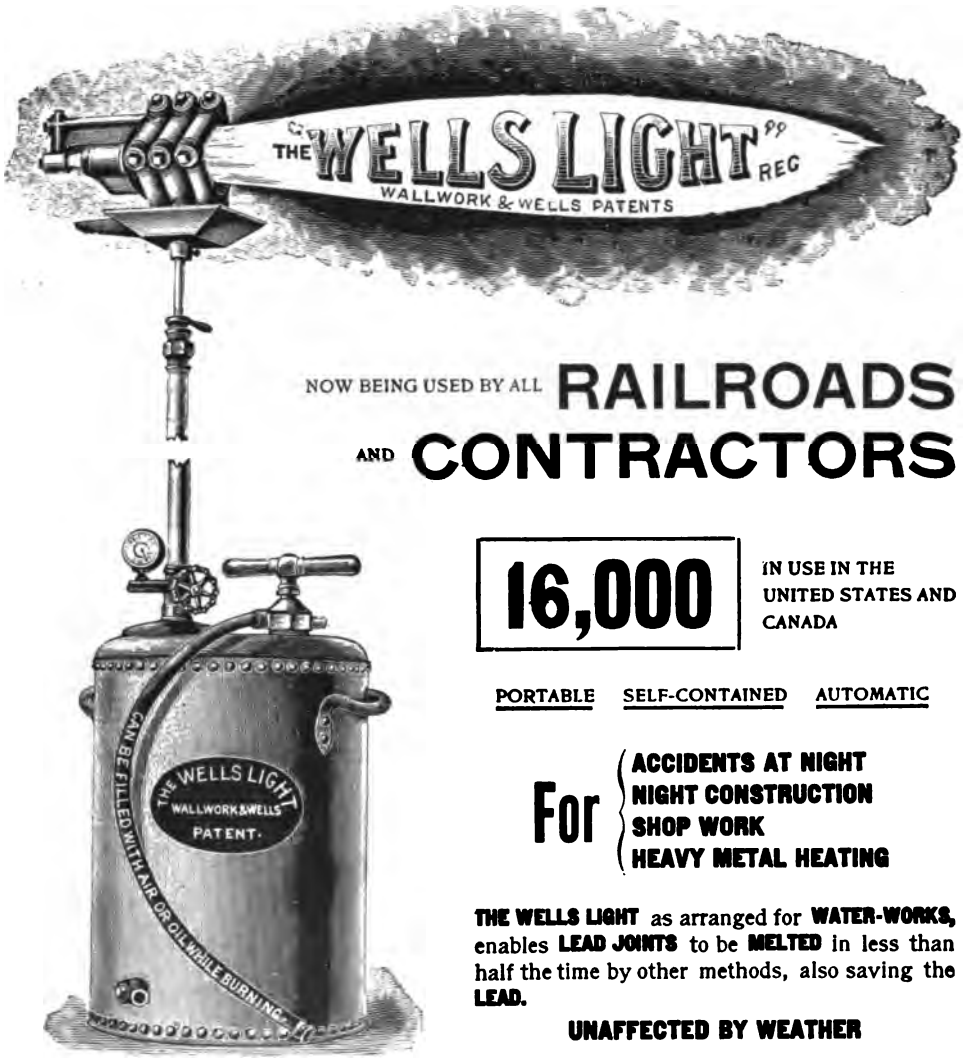

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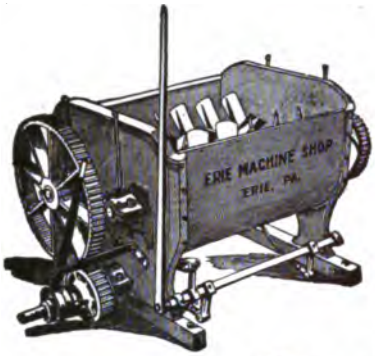

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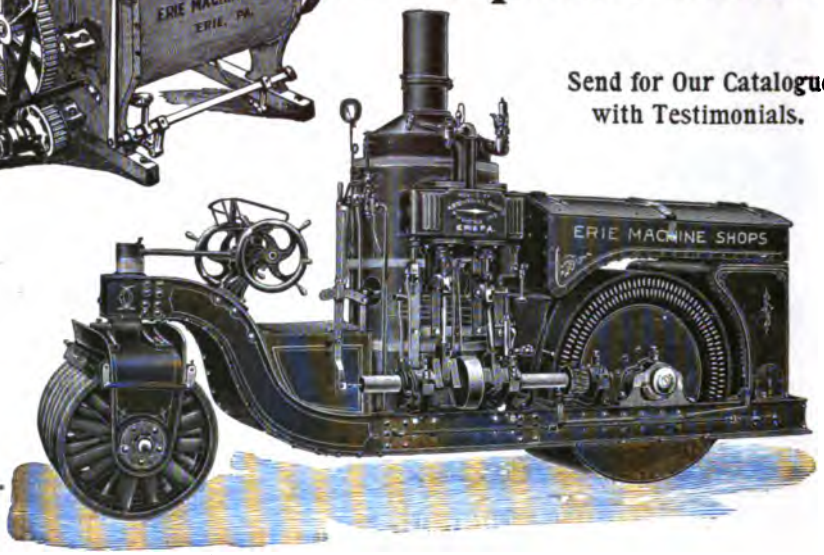

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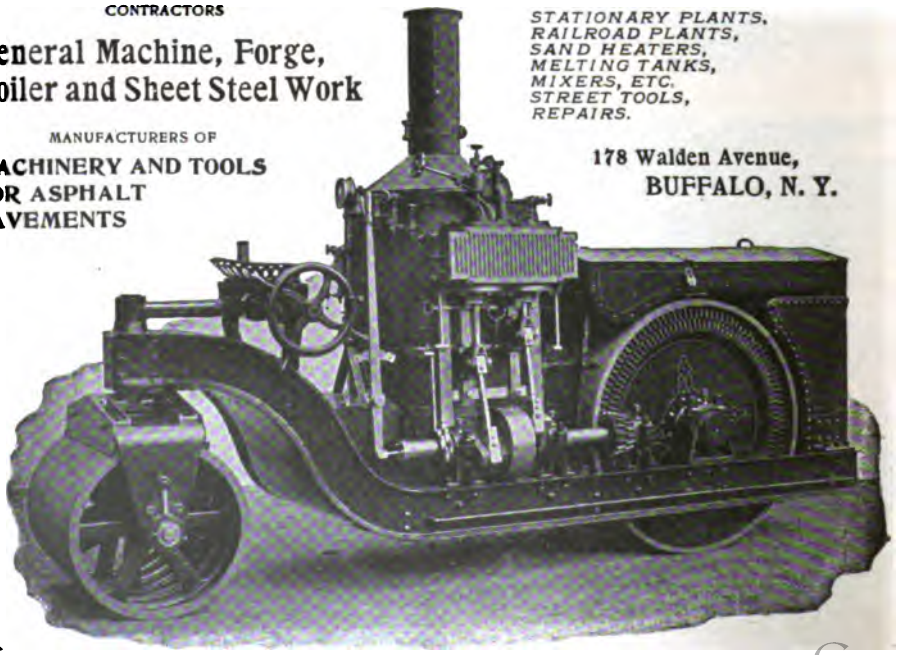

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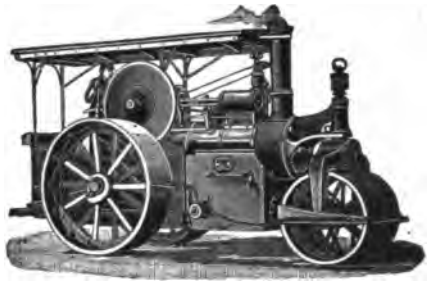

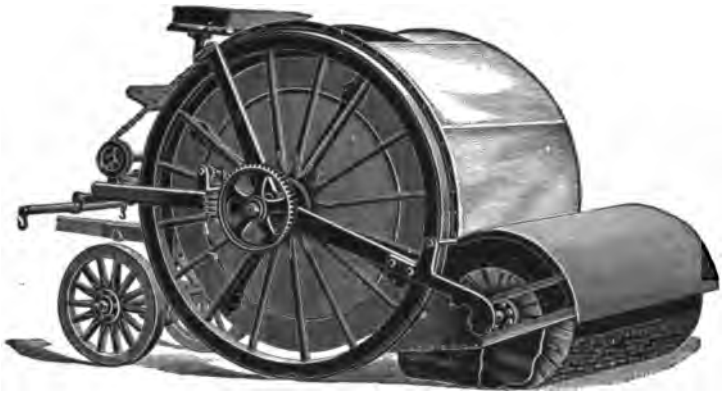

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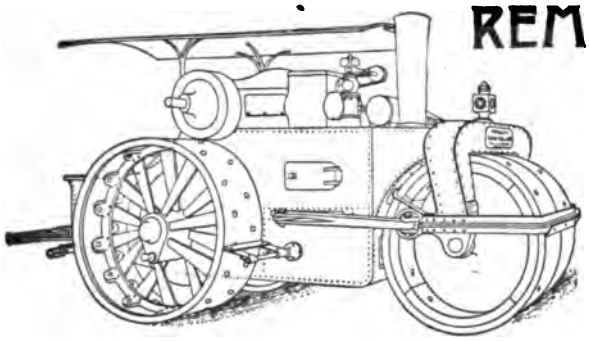

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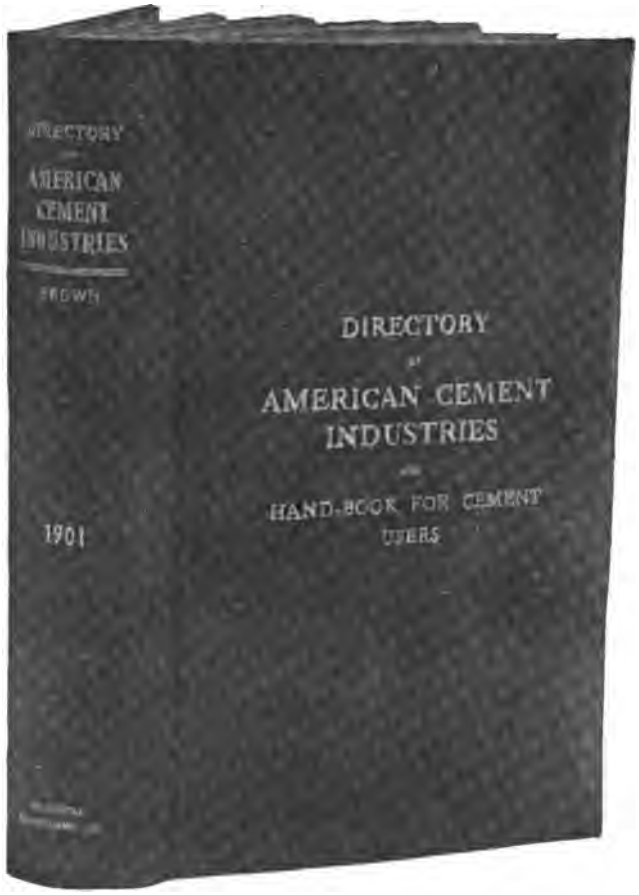

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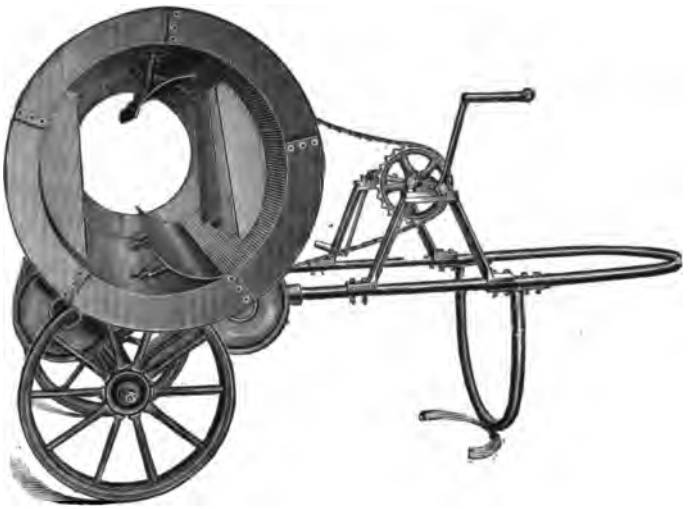

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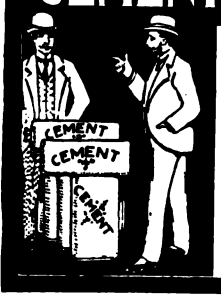

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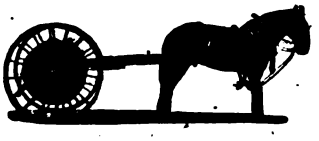

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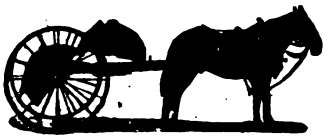

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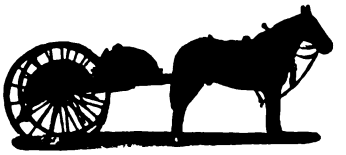

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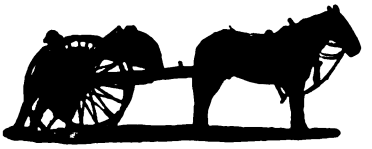

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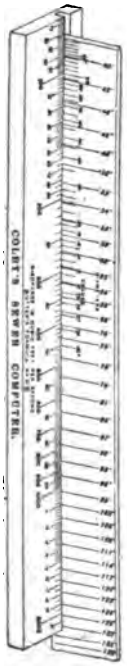

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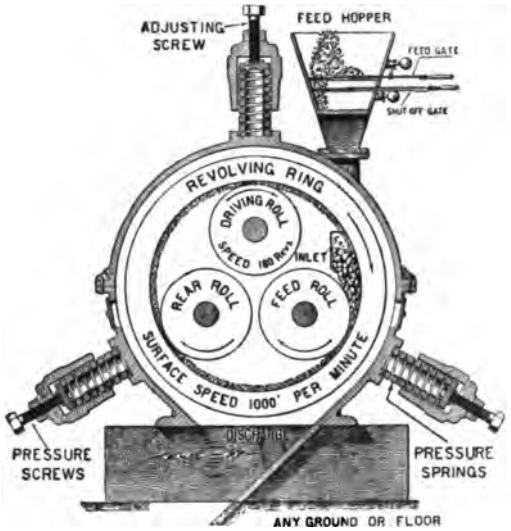

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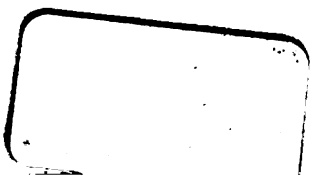

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